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Cover : The Sikorsky S-92 whose cabins are being built by Tatas' at their Hyderabad facility (photo Sikorsky).

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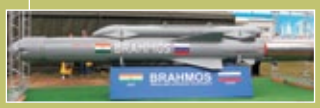

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The Missing Link-CDS Debate Continues (Air Marshal Brijesh D Jayal), The Shangri-La Dialogue (Admiral Arun Prakash), Suppress Paranoia (Tridivesh Maini), The Tail Hooker, British Air Power Centenary, A Sign of the Times, The Tejas and Beyond (Air Commodore Parvez Khokhar)

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The Naresh Chandra Committee

After the Kargil Review Committee (KRC) submitted its report in 2000, the Centre set up four panels to review India's internal security and intelligence apparatus, border management and defence reforms. Based on the recommendations of these panels, in 2001, a Group of Ministers (GoM) came up with a report consisting of 356 recommendations based on the above issues.

The next big impetus for national security reforms came after the 2008 Mumbai terror attacks, when the Union government took some steps to strengthen the country's internal security. It set up the National Investigation Agency (NIA) and the National Counter Terrorism Centre (NCTC).

There is no doubt that the government has spent a large amount of resources on police modernisation, strengthening of intelligence agencies and setting up of new institutions like the National Disaster Management Agency, National Technical Research Organisation, Defence Intelligence Agency and Computer Emergency Response Team. It has also taken some steps to integrate the armed forces with the Defence Ministry, establish the Nuclear Command Authority and Strategic Force Command and the Andaman & Nicobar tri-service joint command and streamline defence acquisitions.

However, loopholes still exist. The national security institutions that were set up after the Kargil War are not working well because they don't have adequate staff or resources. As a result, the 14-member task force on national security headed by Naresh Chandra, a career bureaucrat, was set up on 14 July, 2011. The committee has tried to contemporarise the Kargil Review Committee's recommendations and has examined why some of its crucial recommendations relating to border management and restructuring of the apex command structure in the armed forces have not been implemented, especially since the Kargil Review Committee had clearly stated in its report: "The political, bureaucratic, military and intelligence establishments appear to have developed a vested interest in the status quo.'' The report of the Naresh Chandra panel was submitted to Prime Minister Manmohan Singh in May 2012.

The report recommends the creation of a permanent post of Chairman of Chiefs of Staff (COSC) without affecting the autonomy of the three Service Chiefs, on the lines of the US military and creation of a separate command for Special Forces to function under the Chairman, Chief of Staff Committee. At present, the Indian Army has the control of key elite Special Forces.

To improve the relations between the defence forces and the ministry of defence, the Naresh Chandra Committee has also suggested the deputation of army, navy and air force officers to the Ministry. This recommendation must be taken forward without delay. Hopefully, the recommendations of the panel will not be put in the cold storage like the Kargil Review Committee report.

(Pran Vasudeva in Hindustan Times)

A New Chief

As General Bikram Singh takes over as the new army chief, what should have been a seamless and unremarkable transition is a fraught moment. Events over the last several months have taken their toll on the army's inner equilibrium, and disturbed its poise in the democratic mosaic. There was a PIL against the appointment of Bikram Singh, alleging communal prejudice in high-level appointments. The court dismissed the PIL, but echoes of that shrill campaign have yet to fade. A four-year-old report on Indian peacekeepers in Congo is being flogged although a court of inquiry exonerated all officials of charges of misconduct. There is a showcause notice and a discipline and vigilance promotion ban against Lieutenant General Dalbir Singh, the frontrunner to become the next army chief. Earlier, the sequence of events set in motion by the decision of the outgoing army chief General V.K. Singh to openly confront the government on the date of birth issue saw an unprecedented fraying of civil-military equations. That relationship may not always have been a happy or an easy one. But under V.K. Singh's watch, new chasms opened up between the political and military establishments, shining unflattering light on a lack of judgement and wisdom on both sides. Most disturbingly, the sheen appeared to be taken off one of the settled certitudes of India's democracy that also contributes to its enduring stability — the supremacy of the political-civilian leadership over the military.

The new army chief seems to acknowledge the enormity of his task. In an interview to Sainik Samachar, a journal of the armed forces, the General highlighted the need to strengthen the army's "work culture" and spoke of its "cherished core values". He emphasised that "all commanders must endeavour to create a climate during their command tenures that hinges on... professional ethos and is conducive for growth and cohesion". Admittedly, there is work to be done on several fronts. For instance, to burnish the army's operational preparedness and to ensure that the modernisation process doesn't slow down. Yet, for the new chief, the primary task will be to repair and to restore.

What the army needs, most of all, is to get back its ease with itself and vis-a-vis other institutions. The test of General Bikram Singh's leadership of an institution that embodies a shared national purpose in a diverse and argumentative democracy, and one that he has served since he was commissioned as a young officer into the Sikh Light Infantry regiment on 31 March, 1972, will lie in how he takes up this challenge.

(From : The Indian Express)

The Final Frontier

No one truly thought that the defence secretaries of India and Pakistan would seriously discuss a solution to ending the militarisation of the Siachen glacier. And yet Shashikant Sharma of India and Nargis Sethi of

Pakistan must have gauged each other to see how far the other would go, even as they role-played a pre-scripted conversation.

According to a report; the "atmospherics were good and certain proposals were exchanged". Considering Prime Minister Manmohan Singh is said to be contemplating a visit to Pakistan before the year is out - and the fast-moving political situation in that country means that a caretaker government (to oversee elections scheduled for early 2013) could be in place as early as October-November - the Indian defence secretary's observations and analysis of his 72 hours or so in Islamabad-Rawalpindi will be extensively mined upon his return home.

That means the prime minister will have to soon take a call on whether or not he wants to go there. The window of opportunity is narrow, but that's not all. Fact is, for an Indian Prime Minister to visit, both parties must put something substantial on the menu. Certainly Pakistani President Asif Ali Zardari, whose government is Pakistan's first to have ever completed five years in power, as well as Dr Singh, are both looking at their respective legacies.

This is his opportunity to get it right. In early 2007, he was said to have contemplated a visit to Pakistan on the back of back-channel negotiations with the erstwhile General Pervez Musharraf, after both sides stitched up a mutually honourable roadmap on the Jammu & Kashmir dispute. Gossip was that even the streetlights of the PM's beloved home-village Gah had been fixed in anticipation of his visit.

The only way forward is to invoke the same hard-headed approach in the resolution of the Siachen and Sir Creek maritime disputes. Dr Singh must know by now that the trade breakthrough was achieved when the Pakistan Army came on board. Certainly, Zardari must be given full marks for the way in which he has manoeuvred domestic politics and ignored the sniggering from Aden to Adelaide on his playboy ways, by creating that much-needed democratic space between the all-powerful army and its barely-hidden nexus with religious extremists.

Perhaps it's too simplistic to say that the recent invitation to an Islamabad-based Indian correspondent to visit the Siachen glacier by none other than the Pakistan army chief Ashfaq Kayani is a truce message to the Indian establishment. But off-the-record conversations with long ago-and-recently-retired armymen in Pakistan confirm that Kayani & Co may just be looking for an honourable way to get off those ridiculous heights in Siachen - the Indians are of course even higher, on the Saltoro ridge, ostensibly preventing the Pakistanis from connecting with the Karakoram Pass and therefore, China - and admit that Kargil was a major misadventure that should never have happened.

A frank conversation on Siachen might just become the key that unlocks the Kashmir vs terror dispute that has scarred the India-Pakistan relationship since the beginning of time.

(Jyoti Malhotra in The Times of India)

Urgent Arms Treaty

The world is awash in conventional weapons, like tanks, firearms and aircraft, with the market valued at $40 billion to $60 billion a year. Far too many of these arms are fueling conflicts and atrocities in Syria, Sudan, the Democratic Republic of Congo and beyond. They have been used to kill countless civilians, and they will be used against countless more if the international community does not find a way to keep them out of the hands of unscrupulous regimes, militants and criminals.

The United Nations is trying to do just that. On 9 July, after a decade of lobbying by human rights groups, United Nations members began negotiating a global treaty to regulate international trade in conventional arms. Agreeing on a strong treaty will not be easy. The pact is supposed to be adopted by consensus at the end of the month, and a single country could block any deal.

The talks bogged down on the first day on an unrelated issue involving the Palestinians. It was eventually resolved, but time was wasted. That was a warning to the countries and the coalition of arms control and human rights groups supporting the treaty that success will require vigorous efforts to keep the negotiations on track.

To be effective, any treaty should be legally binding and cover a broad range of weapons, including ammunition. Governments should be required to regulate the international sale and transfer of these weapons, perform risk assessments before authorising a sale, and track the use of the arms. The treaty should bar governments from selling arms to any states under a UN arms embargo and when there are human rights concerns.

Not surprisingly, Russia, China, Iran, Cuba and Pakistan are balking at the human rights criteria. They are also resisting the ammunition provision, as is the United States, which says it is impractical because ammunition is difficult to track.

The United States is the world's main arms exporter and President Obama deserves credit for reversing US policy in 2009 and agreeing to back an arms trade treaty. Now he must lead the way in ensuring that the final document is robust. Predictably, the Administration is under pressure from the gun lobby even though it has vowed that it will not approve any treaty that impinges on Second Amendment rights.

Only 52 of the world's 192 governments have laws regulating arms brokers, and fewer than half of those penalise violators. The United States and a few others have good national controls, and there are 26 UN, regional and multilateral arms embargoes in place. Still, the international system is so haphazard and has so many loopholes that weapons still get through. A study by Oxfam found that from 2000 to 2010, arms worth $2.2 billion were imported by countries under embargo. Syria, for instance, still receives weapons from Russia and Iran even though its security forces have killed more than 13,000 protesters. Trade in virtually every major commodity, from oil to bananas, is subject to international agreements. It is absurd that conventional arms are not subject to strong controls.

(From International Herald Tribune)

OPINION

Admiral Arun Prakash, former CNS, on

The Shangri-La Dialogue

'Anodyne' Antony belied expectations

'Shangri La' is the remote Himalayan monastery in James Hilton's 1933 novel where the survivors of a plane crash receive, from the presiding Lama, a unique philosophy of moderation and pacifism. Even though the 'Shangri La Dialogue' (SLD) has a less exotic provenance (it is named after the Singapore hotel which provides the venue) the aims of this annual conference, organised by the International Institute for Strategic Studies (IISS), are no less lofty.

The SLD has become a facilitator and catalyst for the development of defence and security initiatives in the Asia-Pacific and an important Track 1½ rendezvous for national security functionaries.

Inaugurated by the Indonesian President Dr. Yudhoyono in the presence of the Singapore PM, the 11th SLD, held on June 1 and 2, 2012, had amongst others, the US Secretary Defence, as well as the Defence Ministers of Australia, France, Japan, India, Indonesia, Malaysia and Myanmar speak during plenary sessions. The orations during the course

Dassault

of this event provide an opportunity for the speakers to clearly articulate national security perspectives before an influential international audience which takes careful note and often responds during a traditionally freewheeling Q&A session. Structured break-out sessions are used to bring focus on critical areas. A scan of important speeches shows that, like every other year, the 11th SLD, too, provided many valuable insights which Indian policy-makers need to take note of President Yudhoyono's keynote address struck an unusually (for that country) positive and upbeat note, speaking of Indonesia's growing economic confidence and military influence. He defined a strategic culture of "inclusive regionalism" and offered comfort to countries passing through the Arab Spring by candidly quoting Indonesia's own example wherein things had "got worse before they got better".

He urged the ASEAN-China Working Group to speedily formulate the Code of Conduct for the South China Sea. In his call for the Indian Ocean to be kept free of new rivalry, India found no mention. Offering assurances of transparency in the context of Indonesia's ongoing military modernisation, he lent strong support for the principle of "partnership diplomacy".

The SLD is, customarily, the setting where the US offers to its often insecure Asia-Pacific partners an annual reassurance of continuing regional commitment. Defence Secretary Leon Panetta did more than that as he promised a "deeper and more enduring US partnership role", designed to advance security and prosperity of the Asia-Pacific through "rebalancing."

Speaking of a new defence strategy, he claimed that a smaller and leaner US military of the future would be agile, flexible and quickly deployable, ensuring worldwide presence through rotational deployments and creation of new partnerships. The US Navy's 60 : 40 "re-posturing" between the Pacific and the Atlantic Oceans would manifest itself in the allocation of six aircraft carriers, a majority of cruisers, destroyers, littoral combat ships and submarines to this region.

In the context of India, he marked it out as a country likely to play a "decisive role in shaping the security and prosperity

AK Antony at the Shangri-La Dialogue.

of the 21st century world" and reaffirmed US interest in building a strong security relationship with it.

In the other speech of note, delivered by Australian Defence Minister Stephen Smith, he pointed to the rise of China as a "defining element of Asia's growing influence" but observed that it should not be allowed to overshadow the rise of India. He pointed out that Australia's joining the Indian Ocean Naval Symposium (IONS) in 2008 constituted recognition of the growing strategic importance, not just of the Indian Ocean - but also of India.

Smith drew attention to potential of the Indian Ocean Rim Association for Regional Cooperation (IOR-ARC), to deal with regional challenges, and emphasised his belief that India, Australia and Indonesia could jointly provide leadership through this forum, which reflects a natural extension of growing bilateral relationships between all three countries. Notable was the Minister's repeated use of the term the "Indo-Pacific" as well as his mention of the possibility of renaming the IOR-ARC as the "Indian Ocean Community".

While acknowledging China as the key to a peaceful and secure Asia-Pacific, most speakers mentioned the tensions arising out of overlapping territorial and jurisdictional claims in the South China Sea. Calling for restraint, and for resolution of these disputes in a manner consistent with international law, speakers rejected the use of threats, coercion or violence. The US national interest in exercising freedom of navigation and pursuing unimpeded commerce was highlighted, as was the oft-expressed hope that the country will join over 160 other nations in ratifying the Law of Seas Convention.

India's Defence Minister AK Antony, in his relatively brief speech, confined himself to issues of a general nature such as freedom of the seas, India's maritime interests and the need for consensus-building to combat threats at sea. Making passing mention of the Indian Navy's role in anti-piracy operations, he expressed satisfaction at India's bilateral exchanges with a number of neighbouring countries.

At this juncture when a West-to-East power shift is said to be underway, and India happens to be one of the two foci of intense geo-political interest in Asia, it would have been natural for participants of the SLD to expect, from a senior Indian politician, something in the nature of a broad policy articulation. Some areas of curiosity in our ASEAN neighbourhood are as to how India views an emerging China; how India intends to use its growing economic and military strength; India's interests in the Indian Ocean and South China Sea; India's vision and aspirations for an Asian security order; and how will India's relations with the other major powers shape security governance in the region?

When compared to the intellectually challenging and thought-provoking utterances of the other speakers, it is likely that the bland and anodyne content of Antony's speech would have disappointed his admirers and other delegates to the SLD. It is customary for cynical analysts to say that given the intensity of Indian politics and uncertainties inherent in coalition governments, India's political horizon remains clouded by domestic issues and the vision of our statesmen extends only to the next session of parliament, or to the next general election.

Be that as it may, unless we make a loud and clear articulation of India's interests, concerns, views and opinions in international forums such as the SLD, we might find that it is the USA, Australia, Indonesia - or even China - which lays down policies for us !

Suppress paranoia, speed up action

Tridivesh Maini writes on how competition with China should not mar our strategies on Myanmar

A major problem which afflicts most sections of India's media and its strategic community is its deeply embedded suspicion vis-a-vis China which is not totally illegitimate but often exaggerated and counterproductive. Take the recent visit of Prime Minister Manmohan Singh to Myanmar. First of all, 12 agreements were signed with a view to promote—amongst other things—more substantive economic engagement, energy cooperation, strategic cooperation, greater connectivity between both countries, agricultural cooperation, joint research and people to people contact .

Dr Singh also sent a clear message that India meant business, by taking along a delegation of top Indian industrialists. Then, of course, he had a fruitful meeting with Aung San Suu Kyi, Member of Parliament and General Secretary of the National League for Democracy and also handed over an invitation for her to deliver the Jawaharlal Nehru memorial lecture on behalf of Congress President Sonia Gandhi.

As in the past, Dr Manmohan Singh refrained from making any uncalled-for statements with regard to China. On the contrary the Indian PM referred to Myanmar as "a possible bridge between India and China". Even Minister for External Affairs SM Krishna made it unequivocally clear that every country "has its own interests".

But if one were to look at some of the discourse emanating from sections of the media and strategic community in India, there seemed to be an obsession not so much with India's bilateral engagement with Myanmar, and where it can improve upon its past record, but more with what China has done in that country.

This excessive obsession with China in different forms, has three clear problems:

First, it distracts us from our long-term foreign policy objectives both in the neighbourhood and outside and clearly conveys the impression that our ties with the rest of the world are being dictated by China's moves. This reflects an insecure mindset, something which only diminishes our global image.

Second, while focusing excessively on China, we tend to deflect all the blame for our shortcomings on the China factor, forgetting our own failures. A significant part of the discourse emanating from India focuses on China's strategy to contain India within South Asia and, of late, through Myanmar. It is not China which can be blamed for India's failure to make more of an impact in important countries like Myanmar.

After all, India's abysmal peformance in project delivery and connectivity can not be attributed to China. It is India which has been slow in the execution of certain projects such as the Kaladan multi-modal transport project, which would provide access to India's North-Eastern state of Mizoram via Sittwe port (north western Myanmar), Tamu-Kalewa-Kalemyo road construction and the Tamanthi hydropower project on the Chindwin river.

Similarly, while cross-border trade between India and Myanmar has been going on for some time, the border infrastructure is poor at both Moreh (Manipur) and Champhai. The abysmal infrastructural development on the Indian side is also likely to delay the Imphal-Mandalay bus service. Compared to the poor connectivity between the Northeast and Myanmar, China's Yunnan province has for long been well integrated with Myanmar and has been an important connector.

Finally, the excessive China obsession in India has another significant drawback. It obliterates some of the important positives of the relationship such as increased bilateral trade between both countries and the increased comfort level between political leadership of both countries.

Apart from this, both countries are prominent members of BRICS and in a recent summit supported each other on a gamut of issues, such as how the West should deal with Iran and Syria. India is also pitching for a more important role in the Shanghai Cooperation Organisation (SCO) of which China is one of the founding members. The decision is likely to be made soon.

In the context of India's immediate neighbourhood too, there have been some positives. Chinese support for economic engagement between India and Pakistan has been unequivocal. In the aftermath of the coup in Maldives, China was quick to assure India that it was in no mood to fish in troubled waters. The Chinese leadership welcomed Dr Singh's visit to Myanmar.

If India is to get over its China obsession, it is imperative to realise that security concerns are a crucial, but not singular component of a country's external dealings. Policies and mindsets of 2012, can not forever be held hostage to the events of 1962.

THE MISSING LINK

CDS DEBATE CONTINUES

Photograph has India's Prime Minister, Defence Minister, the three Service Chiefs, Defence Secretary and other senior officers at a recent Joint Commander's Conference at New Delhi.

Some commentators have likened the recent low in civil-military relations to events preceding the humiliation suffered by the Indian military at the hands of the Chinese in 1962. Others recall the quote: "Those who cannot remember the past are condemned to repeat it". Either way whenever the country endeavours to take some steps towards modernisation of its archaic defence management, vested interests within stall progress. As we await information on the latest such effort by the Naresh Chandra Committee, perhaps falling back on history may be the only way to prevent repeating the past.

The debate on reforming the security management system really took off after the government appointed the Kargil Review Committee, which not only presented its report in a very short time, but also published a non-classified version as a book. Certainly a pleasant first in an otherwise security obsessed system of security management where scholars still await declassification of reports of earlier conflicts half a century back ! The government followed with appointing four task forces to study different aspects relating to security.

The Task Force on Management of Defence was chaired by Arun Singh, the erstwhile Minister of State for Defence under Rajiv Gandhi who also chaired the Committee on Defence Expenditure when VP Singh was the Prime Minister. In intellectual and security management experience terms, the choice of Arun Singh was sound.

In two crucial areas that have a direct bearing on civil-military relations, the task force made some crucial recommendations. On the subject of integration between the services and single point military advice to the government, it recommended a Chief of Defence Staff heading an Integrated Defence Staff. On the issue of service head quarters being outside of the ministry of defence, and the services' long standing grievance of being controlled by the civil service rather than the political executive, it differed with the KRC, which had proposed integration of the respective service head quarters with the MOD.

Instead Arun Singh proposed changing the nomenclature of service head quarters from 'attached offices' to 'integrated HQ' albeit with greater financial powers to the services and greater involvement of services in decision-making through committees. Since historically a trust deficit prevails in the minds of the political leadership about the military, which in turn makes the civil service the arbiter in most

Airbus Military

matters civil and military, it is no surprise that change, in this regard, has merely been cosmetic as commented upon by a recent Parliamentary Committee on Defence.

It is, however, on the issue of the CDS that there continues to be a robust, though

INS Vikramaditya preparing to leave harbour for sea trials in the White Sea (off Russia).

an inconclusive, debate. Recent media reports suggest that the Naresh Chandra Committee has now recommended a permanent Chairman of the Chiefs of Staff Committee. Whilst no details have yet become available, one thing is certain. The old debate is all set to be reignited with the Indian Air Force once again in the line of fire!

The CDS Debate

Anit Mukherjee writes that when the BJP government was taking steps towards implementing the CDS they faced opposition from different quarters, but the fiercest resistance was from within the services especially the IAF, which has historically feared loss of its identity and autonomy and domination by the army. He mentions an attempt by Arun Singh at consensus by calling a meeting of 17 ex Chiefs to his task force deliberations and whilst 11 favoured the CDS the 6 against were all from the Air Force! It was further lobbying by former Air Chief Marshals who wrote to the President and prominent political leaders that culminated in the then CAS ACM Tipnis to formally come out against the CDS.

Admiral Arun Prakash, a member of the Arun Singh Task Force recalling it's deliberations reflected: "Possibly to pre-empt further attempts at 'poaching', the IAF insisted that unless 'Roles and Missions' of each Service were clearly delineated (and frozen), it would be pointless to discuss any changes in management structures. This was, however, a difficult proposition, and the IAF objection remained outstanding." Arun Prakash does not elaborate on why this very vital issue, and one which continues to be revisited by other countries on a continuing basis, was considered a difficult proposition and summarily dismissed.

The latest on the controversy was when the erstwhile CAS and Chairman COSC Air Chief Marshal Naik stated that whilst the IAF was not opposed to the appointment of a CDS, it did not want one in the present form. He then posed a question of what role model of CDS did we want, finally concluding that there was no need for a CDS for the next 5-10 years ! Since this was perhaps the clearest articulation made by the IAF on the subject, it naturally resulted in considerable debate amongst the strategic community. In response, Gen. VP Malik and Anit Mukherjee have argued that the IAF should have 'after ten years' been able to articulate as to what form and model of CDS would meet the IAF's acceptance as also sanctity of the 5-10 years wait.

Pravin Sawhney writes on his interview with Naik during the latter's farewell interaction with the media in July 2011 when in reply to a question whether the IAF was in favour of a CDS he got a firm "no". His justification is quoted : "I would favour the CDS if it was held after a national debate, and the CDS is appointed as the single point military advisor to the defence minister". Adding further "To my mind, the CDS is five to ten years away as we require the requisite technology like Integrated Command, Control and Computer Systems (ICCCS) before we have the CDS. As the defence services today are meant for territorial defence, the CDS is not needed." A rather omnibus rejection, but no real clarity on what the IAF's alternatives actually were!

Although it is the IAF that seems to be the odd one out, it would perhaps be fair to assume that the other two services are not overtly wedded to this concept either. Although the Navy has generally been silent, in 2007 it was Gen. JJ Singh the then COAS and Chairman COSC

who indicated that the time was not ripe for a CDS and that such a requirement could be considered a mid-term or long term one once the J&K, internal and boundary issues were overcome. This was well before Naik's 5-10 year timeline although the IAF's opposition predated this.

Also contrary to popular belief that it is only the IAF's reluctance that is stalling this reform, neither the civilian bureaucracy nor the political parties are in favour of promoting this concept for their own parochial reasons. The former as they fear this might create a powerful position dominating the MOD and the Cabinet Secretary. The latter perhaps because consensus amongst our political parties is not easy and is presently awaited. Lack of consensus amongst the services makes it convenient for the political executive to maintain such status quo.

There is little doubt that amongst the services it is the IAF that has been most vocal in its non-acceptance of the concept of a CDS. Unfortunately what is missing is a well reasoned argument to back this view and articulation of what needs doing to make this a reality. Clearly, if the nation wishes to keep up with challenges of modern warfare, that is being driven by technology and integration, there is a need to progress on the twin important issues of reorganising defence management to include the concept of a CDS or Chairman Joint Chiefs of Staff along with integrating service headquarters with the MOD. But the vital first step must be at resolving inter service reservations and to harmonise their thinking such that there is unanimity amongst them.

Indian Air Force Su-30 MKIs on exercise.

Roles and Missions

History tell us that inter service rivalry is not new and at the heart of the rivalry is either the very survival of the service as an institution or the threat to its role or purpose as defined in its charter flowing from which come mission capabilities that it must develop and deliver. In *Air Force Roles and Missions : A History*, Warren A. Trest succinctly sums up by saying: "Simply put, roles and missions…can make or break a service". Since the armed forces are institutions steeped in history and tradition, it is worth exploring the past in order to understand present institutional thinking towards answers into the future.

In this search one significant point that emerges is the role that technology has played and continues to play in the perennial inter-service turf war on 'roles and missions' as it was the advent of air power that actually created the first disturbance to status quo in warfare. Not surprisingly, aerospace technology and its rapid advancement continue to create ripples amongst armed forces of many countries, not excluding India.

The US Experience

Until the 20th century the issue of roles and missions of the army and navy did not arise in the US as they fought respectively in their mediums of land and sea. With the advent of military aviation this dominance was threatened and the US Navy, fearing loss of its naval aviation, opposed the National Security Act of 1947 through which an independent USAF was finally born.

Following this the then Defence Secretary gathered the service chiefs at Key West in an attempt to settle the contentious issue of 'roles and missions' and thus came into being the 'Key West

Agreement' that established primary service responsibilities and assigned secondary or 'collateral' missions. Significance of air power dominating the debate ever since was evident when the Navy agreed not to pursue its own strategic air force whilst the Air Force agreed that carrier aviation would be left to the navy.

Notwithstanding this, the navy then proceeded to develop a 'super carrier' big enough to handle two aircraft, the AJ-1 Savage and P2V-3C Neptune, to carry nuclear bombs. This was in competition with the Air Force's B-36 strategic bomber being developed for its defined power projection mission. In 1949 the Secretary of Defence cancelled the 'super carrier' project setting off the so-called 'Revolt of the Admirals'. The navy then instigated a campaign against the B-36 programme alleging fraud and misconduct. This ugly stand off finally culminated in the Chairman Joint Chiefs of Staff declaring that the real issue was refusal by the Navy 'in spirit as well as deed' to accept unification. The end result was that the B-36 programme went ahead whilst the 'super carrier' was cancelled.

Title 10 of the US Code has since 1956 been the legal basis in the US for roles of the armed forces through which the broad and enduring purpose of each service is established. Flowing from these and in amplification are assigned primary or secondary missions to the services by the President or Secretary of State. More recently it is through the Quadrennial Defence Review that Title 10 requires the Chairman JCS to assess 'roles and missions', consider unnecessary duplication of effort among the armed forces and provide an assessment to the Secretary of Defence.

In 1992 Chairman Armed Service Committee Senator Nunn wanted a 'no holds barred' review and wanted correction to redundancy and duplication that existed amongst the armed forces. With each of the four services operating tactical aircraft, he said, "we must find ways to save billions of dollars with streamlining and eliminating the duplication in this area." A *New York Times* editorial even asked "who needs four air forces?"

The U.K.Experience

It was a sub committee of Imperial Defence led by Gen David Henderson that developed the master plan for the Royal Flying Corps in 1912, which consisted of a military wing and a naval wing. Inevitably, the two wings drifted apart and in 1914 the Naval wing was designated the Royal Naval Air Service. Even at that early stage there was a debate within the navy on whether the RNAS should devote its efforts towards strategic bombing or to concentrate on cooperation with the fleet. It is interesting though that RNAS had already approached Frederick Handley Page to develop for the RNAS a 'boldly paralyser of an aeroplane' (an amateurish way to define a service requirement) that led to the Handley Page 0/100, the first British strategic bomber.

The overlapping of functions between the RFC and RNAS along with competition for aircraft, engines and supplies led to serious thinking of the way military aviation should be organised and thus was born the RAF in 1918 some months before the close of WW1.

The period between the two wars saw the RAF fight for its survival, first from the Navy and Army who preferred it disbanded and redistributed back to the army and navy from which it was born and then against government economy cuts. The RAF–Navy tussle was resolved in the RAF's favour in 1923, but the Navy finally succeeded in getting an independent Fleet Air Arm in 1937.

The decision in 1947 to develop an atomic bomb for delivery from an RAF bomber added another responsibility to the RAF. On the other hand with the failure of two nuclear missile projects and the acceptance of the Polaris missile for nuclear deterrence, the RAF lost this role to the Navy. In the 1950s both RAF and the RN were also developing platforms for the AEW role but with the cancellation of the large aircraft Carrier in 1965 the role reverted to the RAF.

Following the recent Strategic Defence and Security Review, the UK is presently restructuring its MOD, the armed forces and their joint war fighting in a major way. In parallel, recommendations of a separate study into the structure and management of the MOD are being implemented to ensure that defence is delivered as effectively and efficiently as possible.

India's Story

At independence, India inherited the three services with their 'roles and missions' defined as were existing in the UK. In the initial years artillery officers performed the air observation role for the army with the aircraft belonging to the IAF. Whilst the IAF was responsible for training and support of the fleet, the army exercised command and control during operations. This continued even with the advent of helicopters although helicopters brought in a sea change in other areas like communications and the ability to operate without airfield infrastructure. Quite naturally the army now felt the need to have its own helicopters and after a prolonged and sometimes bitter inter service battle the AOP helicopters were transferred to the army.

At the time, as indeed till today, the attack helicopters have remained with the air force although the army continues to fight for their control. Over the years many an army chief has called for the close air support role also to be transferred to the army, often complaining that the IAF lays greater priority to Counter Air and other roles at the cost of the former. The deeper impact of this type of turf war is best illustrated (from this writer's personal involvement) by the example of the HAL Advanced Light Helicopter.

During the formulation of Air Staff Requirements for an indigenous Advanced Light Helicopter in 1977-78 the IAF had called for a machine that would have met with critical high altitude requirements. It is noteworthy that this was well before the so-called Siachin dispute. Because the requirements were extremely demanding, IAF faced criticism and pressure from the industry to dilute these. Whilst the IAF stood its ground, the army insisted on a larger machine and was discreetly supported by the industry for obvious reasons. It is poetic justice that whilst the ASR for the ALH has resulted in the Dhruv helicopter, an exceptional helicopter in a heavier class, the army is now struggling to procure advanced light helicopters of the class they would have had, had they not played spoiler! The larger issue is that such parochial and subjective differences come at great cost to national security with no historical learning or institutional accountability.

Avi Oil

It was in 1939 that six Coastal Defence Flights were raised on a voluntary basis around a nucleus of RAF and IAF personnel to be replaced in 1942 by RAF and Fleet Air Arm units. Post independence the IAF took on the maritime reconnaissance and air sea rescue role with a squadron of Liberators, which were followed by Super Constellations.

The Navy formed its first Fleet Requirement Unit in 1951 for purposes of providing aircraft targets for gunnery and radar tracking with Naval Air coming into being in 1953. This was to be the beginning of a turf war with the IAF that continues to this day. Whilst the INS *Vikrant* joined the IN in 1961, the Navy had already been pushing for the transfer of the maritime role from the IAF. In 1973 the MOD agreed in principle for the Navy to procure four Il-38s, for which contract was signed in 1975 followed by the decision to transfer command and control of MR/ASW from the air force to the navy. The IAF Chief then offered to immediately transfer the Super Constellations to the navy.

How casually such far-reaching decisions were taken is best illustrated by the narration of history of Naval Air Arm. Two viewpoints by erstwhile Chiefs best indicate the inter service trust deficit.

Air Chief Marshal Moolgavkar recalled, "At the beginning of my tenure, I felt that it would be the right and correct thing to do, that the Navy should be given Super Connies now, a year and a half in advance, so that they could familiarise to operate heavy aircraft. Any mistakes the Navy made or any accidents would be on these old aircraft and not on the new Il-38s. Surely this is reasonable thinking?'

From the navy viewpoint, Admiral Tahiliani had a different take "So, although our Air Force friends might have thought that they were going to frighten the Navy into accepting a commitment we would not be able to cope with, in the bargain they gave us an opportunity, by grabbing which we were able, once and for all, to put this question of the operation of long range maritime ASW aircraft behind us".

It is worth recalling this story because it indicates the subjective and personalised nature of decision making in relation to such complex operational and organisational matters as 'roles and missions.' Whilst scientific tools of Joint Warfare and System Analysis were not as mature at the time, this was ad hocism at its worst. Unfortunately even today the approach has not changed.

The IAF has continued with the maritime strike role, first with Canberras and then with Maritime Jaguars specially designed with Agave anti-ship radars and Sea Eagle missiles. That the IN has been luke warm to these high cost assets solely dedicated to maritime strike is partly owing to it wanting even this role to be transferred to it. With induction of the P-8I and MiG-29K, this cry is only set to get louder.

On the other hand, the earlier limitation of range of shore-based maritime strike aircraft is now academic with the IAF having inducted flight-refueling capability for the Jaguars, Mirage 2000s and the Su-30MKI. Will the navy deny itself this potent capability, just because it is in the hands of the air force or will it exploit it to the larger good? Judging by history the IN-IAF tussle for 'roles and missions' in the maritime air domain is only set to intensify.

In the early 2000s during negotiations for the aircraft carrier *Admiral Gorshkov* and other systems there were serious reports of the Navy getting on lease four Tu-22M3s meant for the strategic and

The Indian Army has ordered a relatively large number of HAL ALHs.

long-range maritime strike role. Whilst no formal reports ever appeared, the IAF suspected that much like the Il-38 story that preceded the maritime recce role being taken away from the IAF, this was a precursor to taking away of their maritime strike role as well! Again learning from the history of both the US and UK navies, this was also seen by IAF as an attempt by the navy to venture into the IAF domain of strategic strike, more so since India had by now articulated its Nuclear Doctrine.

It is perhaps these perennial turf wars between the services, all relating to 'roles and missions' that must have prompted the Prime Minster to tell the Combined Commanders Conference in October 2011: "The Government will never fight shy of finding the funds for the modernisation of our forces. At the same time we have to recognise that resources are not unlimited. I would urge upon you to optimise the use of scarce resources. You are the best judges of how this can be done, but advance and long term planning and the creation of common institutions, communication networks and infrastructure are some examples of how this could be achieved. We should keep this in mind particularly when we build new capacities for meeting emerging threats".

Lessons Emerging

History tells us that with advent of air power and birth of air forces as independent services, there have been continuing inter service turf wars, which affect the institutional psychology of each service in its own way. The army and navy resent losing out on their air roles to a new service, the air force. The latter in turn beleaguered initially about its very survival being threatened and subsequently as its 'roles and missions' were preyed upon.

It is also interesting that the means adopted by the services to expand their 'roles and missions' have often taken advantage of evolving technology to procure platforms and weapon systems regardless of duplication and redundancies and consequent burden on defence budgets. With technology's advance especially in space, aerospace and IRS systems, inter-service battles to expand service domains have only got fiercer, though perhaps subtler.

So what we are witnessing in India is nothing new. In the past the air force has lost ground to both the army and the navy and neither service has stopped eyeing the air forces' 'roles and missions'. It is this psychology borne out both by history and recent experience that makes the air force wary of its sister services. It is possible that it is this institutional psychology that lies at the heart of its reluctance to endorse a CDS concept as it perceives this to be the thin end of the wedge to its continuing loss of it's 'roles and missions'.

Since evolution of technology is itself driving capabilities that are essential to warfare in any medium land, sea or air, each service desires to expand into newer areas oblivious of the cost of duplication and redundancies in times of scarce resources. On the other hand the main objective of joint war fighting is to exploit the core competencies, unique strengths and capabilities of each of the armed forces towards a common military aim and to do it both efficiently and cost effectively. This, in turn, implies a greater degree of jointness and avoidance of duplication of redundant capabilities through subjective judgments on 'roles and missions' and weapon system procurements. History teaches us that it is futile to expect this dichotomy to be resolved by the services amongst themselves.

Allied to technology are rising costs. As technology drives capability of systems and platforms, it is the cost of fielding and supporting such systems that are becoming a roadblock to building military capability which naturally draws the attention of governments and legislators. This in turn is driving nations to look at integrated and joint warfare, rationalising of 'roles and missions' and delivering defence capability effectively, efficiently and affordably. Inevitably this has resulted in looking at ways and means towards introducing defence reforms, a process that has been ongoing in both the USA and UK at the highest levels of governance.

The Way Ahead

Because of our archaic higher defence organisation, where each service plans in isolation of the others, with arbiters in the MOD having no domain knowledge of warfare, 'roles and missions' and weapon systems, we have a system that has no basis of scientific joint warfare analysis. The bedrock of our planning hence remains subjective and influenced by personalities and personal equations whether between services or between services and the MOD. This turf war is unlikely to end, unless external forces like budgetary factors and parliamentary oversight intervene, for which the time has now come !

For a constructive way forward, it would be prudent to first resolve, once and for all, the issue of 'roles and missions' for each of the three services. To arrive at this there are adequate scientific tools of Joint Warfare Analysis that will keep emotions and subjectivity of yester years at bay. Once the nation legislates on what is the abiding role of each of the services within which the missions it is formally tasked to perform, it will cast historic turf wars aside and let the services focus on developing joint warfare capabilities to fulfill their assigned missions.

Psychologically such a step will allay all institutional fears within the air force of what its role is and what missions it must plan, train and equip for. Equally, it will for all time to come curb any predatory instincts of the other services inherited from the past and they in turn will be able to plan, train and equip for their missions. Within this psychological and legislative framework the necessity of both jointness and integrated operations will naturally emerge stronger.

Laying the ghost of 'roles and missions' to rest will naturally make the services look at joint war fighting in a positive light and in turn appreciate the merits and inevitability of reorganisational concepts like the CDS or Chairman Joint Chiefs of Staff. Equally as far as the MOD and the executive are concerned, the very process of driving the 'roles and missions' legislation through the system will co-opt them into supporting new organisational concepts of both CDS or Chairman Joint Chiefs of Staff and integration of service headquarters with the MOD.

Looking back when within the Arun Singh Task Force the IAF had insisted that the issue of 'roles and missions' be frozen first, it had the foresight to be learning from history. Instead, since then, we have been attempting to shoot the messenger!

Air Marshal (Retd) Brijesh D. Jayal

Tejas LCA completes weapon trials, closer to IOC

According to ADA sources, the Tejas Light Combat Aircraft has "flawlessly" completed weapons trials in preparation for its initial operation clearance (IOC) which is planned before the end of 2012.

"The bombing runs, which were part of trials for the second phase of initial operational clearance (IOC-2) and final operational clearance (FOC), were carried out in late June at the Pokhran ranges. The weapon trials were conducted by three LCAs (LSPs 2, 3 and 5) which deployed a range of weapons, including laser-guided 500kg bombs as also free fall bombs. The LCAs were continuously over the ranges, dropping a variety of armament "which hit the targets on the ground with great accuracy."

The LCAs have also fired R-73 air-to-air missiles against simulated targets which is required for IOC while firing trials with beyond visual range missiles (such as the Derby or R-77) would be part of the lead up to the FOC stage. Defence spokesperson Col SD Goswami has said that the FOC has been delayed but according to defence analysts "this will not happen till 2015".

2nd Boeing P-8I for Indian Navy in 1st Flight

The second Boeing P-8I aircraft for the Indian Navy (IN321) made its initial flight on 12 July, taking off from Renton Field at 1529 hours and landing two hours and 14 minutes later at Boeing Field in Seattle. The P-8I, a derivative of the Boeing Next-Generation 737-800 commercial airliner, is the second of eight long-range maritime reconnaissance and anti-submarine warfare aircraft ordered by the Indian Navy.

During the flight, Boeing test pilots performed airborne systems checks and took the P-8I to a maximum altitude of 41,000 feet prior to landing. Boeing will begin mission systems installation and checkout work on the aircraft in the coming weeks.

"The programme is on plan and the Indian Navy is excited for the P-8I to join its fleet," stated Leland Wight, P-8I programme manager for Boeing. The P-8I has not been given any name by the Indian Navy despite some media referring to it as the 'Neptune'.

Boeing P-8I initiates flight test programme

Meanwhile, on 7 July 2012, the first Boeing P-8I aircraft for the Indian Navy (IN320) began its official flight test programme, operating from Boeing Field in Seattle. Boeing test pilots will also put the P-8I through its paces over a US Navy test range west of Neah Bay, Washington and a joint US -Canadian test range in the Strait of Georgia.

Leland Wight, Boeing P-8I programme manager said "we will start out testing the P-8I's mission system, which includes its sensors and communication systems. The team then will transition to 'stores' tests during which the P-8I will carry inert weapon shapes under its wings to demonstrate that the aircraft is capable of carrying all the weapons the Indian Navy will use during regular missions."

The stores the P-8I will carry will have the identical shape and size of real weapons, including the Harpoon anti-ship missile, depth bombs and torpedoes. "This is an important milestone for the programme and sets the stage for operational testing and weapons certification as we move closer to P-8I aircraft joining the Indian Navy," stated Rear Admiral Davinder M Sudan, ACNS (Air) Indian Navy.

HP

First Indian Air Force AW101 in flight testing

Maiden flight of first of the 12 AgustaWestland AW101 ordered for the Indian Air Force (ZR 338) took place at Yeovil Airfield in Somerset on 18 May 2012. A contract for 12 helicopters for VVIP transportation was signed on 8 February 2010, which included a five-year logistics support package, plus aircrew and maintenance personnel training.

Indian Air Force orders 14 more Dornier 228s

The Defence Acquisition Council has reportedly cleared 14 additional HAL-built Dornier 228 light transport aircraft for the Indian Air Force. The Service currently operates 41 Dornier 228s, which equip No. 41 and 59 Squadrons as also Communication Flights and serve as multi-engine trainers at the Air Force Station Yelahanka.

Indian Army quest for combat helicopters, light transport aircraft

According to persistent media reports, Defence Minister AK Antony has "favourably considered" Army Chief General Bikram Singh's request for procuring attack helicopters,

HAL LCH

Unmanned Aerial Vehicles (UAVs) and for improving airlift capability in the north-eastern region.

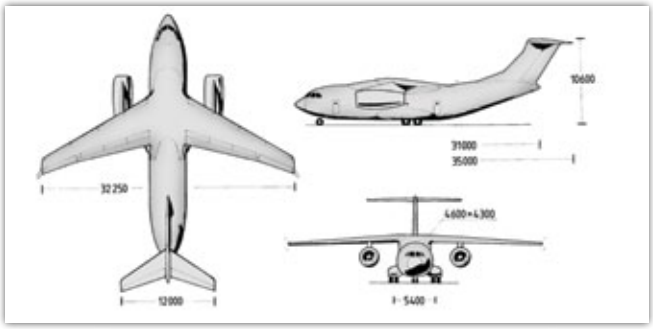
The Army is presently programmed to acquire 54 HAL Dhruv Mk.IV ALHs, named as the Rudra, which will be armed with 20mm turret guns, 70 mm rockets, air-to-air missiles and anti-tank guided missiles. The Army has also indicated requirements for 114 HAL light attack helicopters, currently under flight testing. The Army also plans to raise five squadrons with fixed-wing light transport aircraft for each of its operational commands.

HAL ALH Mk.IV WSI ('Rudra')

However, the IAF has been opposing the Army's demand for air assets of its own, which being capital intensive are "scarce resources", and IAF wants to be the sole repository of these as it has "the operational expertise for rapid deployment." But the Army contention is that "the IAF does not fully understand the Army's tactical battlefield requirements". Further, "while the IAF has as prime responsibility the strategic role of defending the airspace of the country, the Army should have its own assets for tactical tasks."

HAL and UAC-TA to develop Multirole Transport Aircraft

On 28 May 2012, Hindustan Aeronautics Ltd. signed a tripartite General Contract with United Aircraft Corporation -Transport Aircraft (UAC-TA), the Russian partner and the JV-Multirole Transport Aircraft Ltd. (MTAL) for the long planned Multirole Transport Aircraft (MTA) programme. HAL & UAC-TA have proposed the design, development and production of a Multirole Transport Aircraft in the 15-20 tonne class, to meet the tactical airlift requirements of the Russian Air Force, Indian Air Force and the export market, the total requirement for which is estimated at 205 aircraft. Of these, 45 would be for the IAF, 100 for the Russian Air Force and about 60 for other countries.



The joint venture will have its headquarters at Bangalore, where HAL will carry out design and development at its Aircraft R&D (ARDC) Centre while HAL's Transport Aircraft Division (TAD) at Kanpur has been selected for manufacture of the prototypes and subsequently the series production for which dedicated facilities are to be set up. Other R&D Centres and manufacturing divisions will share development of systems, LRUs and components, sub-assemblies as also the composite structure. HAL engineers will simultaneously be working with their Russian counterparts in Moscow as well as in India.

The Indian and Russian governments had sometime earlier signed an Inter Governmental Agreement for joint design, development and production of the MTA on 50:50 sharing basis and agreed to form a JV between HAL, UAC-TA & Rosoboronexport to execute the project. The aircraft will be designed essentially for cargo/troop transportation, para-drop /air drop of supplies including Low Altitude Parachute Extraction System (LAPES).

HAL's Kanpur division has been focused on building transport and trainer aircraft types, beginning with the Avro (HS/BAE) 748, a total of 89 aircraft being built, largely for the Indian Air Force, most of which remain in service. HAL has also carried out a number of upgrades and customisation of these aircraft. From 1984, under a comprehensive contract with Dornier of Germany, variants of the Dornier 228 Light Transport Aircraft have been built, with 116 numbers manufactured till March 2012 with more orders imminent. Exports have also taken place, to the Mauritius while under a special agreement with RUAG, major structural assemblies of the 228 are being exported for completion in Germany.

IAF C-130 Super Hercules deployed to Car Nicobar

The first C-130J Super Hercules of the Indian Air Force was deployed to Air Force Station, Car Nicobar on 28 May 2012, after a 6-hour non-stop flight from Air Force Station Hindan. The aircraft was under command of Group Captain Tejbir Singh, CO No. 77 Squadron.

IAF C-130J Super Hercules at Car Nicobar on 28 May 2012

F117 Engines for IAF Boeing C-17s

Pratt & Whitney has delivered the first four F117 engines for the Indian Air Force to power its fleet of Boeing C-17 Globemaster III transport aircraft. The Indian Ministry of Defence signed a Letter of Offer and Acceptance with the US government in 2011 for the acquisition of ten C-17s, with first delivery in mid 2013.

Four F117s provide the massive power for the C-17 Globemaster III, the world's leading heavy airlifter. The F117-PW-100 is based on Pratt & Whitney's PW2040 commercial engine, which powers the Boeing 757. With more than 50 million hours of proven military and commercial use, the F117/PW2040 has proven itself as "a world-class, dependable engine." Pratt & Whitney's ongoing investment in product improvements has enabled the engine to continuously surpass established goals for time on wing, in-flight shut downs and support-turnaround time.

Akash missiles test-fired from Chandipur range

On 1 June 2012, two indigenously developed surface-to-air *Akash* missiles were test fired from the Integrated Test Range at Chandipur in Odisha, which followed earlier test-firings of the missile between 24-26 May 2012. With a range of 25 km and a warhead of 60 kg, the *Akash* weapon system was inducted into the armed forces in 2008 and is also being developed for the Indian Army.

As per the DRDO, "The flight trial of two Akash missiles was conducted in quick succession from road mobile launchers at launch pad-3 in the ITR at about 1102 hours. During the trials, the missiles were aimed at intercepting a floating object supported by a pilotless target aircraft flown from launch complex-II at a definite altitude over the sea. It was a routine user trial conducted by the Indian defence forces after the completion of developmental test and induction into the defence inventory."

Agni 1 ballistic missile successfully launched

On 13 July 2012, Agni 1, the 700 km range ballistic missile was successfully launched at 1006 hrs from the Wheeler Island off the Odisha Coast. "It was a textbook launch meeting all mission objectives and the missile reached the target point in the Bay of Bengal following the prescribed trajectory" informed Avinash Chander, the mission Director who is Chief Controller R&D (Missiles & Strategic Systems) and Programme Director Agni programme. The missile was launched from the Road Mobile Launcher System and was tracked by radar and telemetry stations located along the coastline. Two naval ships located near the target point tracked the missile in the terminal phase of the flight.

Indigenously developed by DRDO the missile is already in the arsenal and was launched by the Strategic Forces Command as part of a training exercise "to ensure preparedness." The launch was witnessed by Dr. Vijay Kumar Saraswat, SA to RM, Avinash Chander, CC R&D (Missiles & Strategic Systems), and Programme Director Agni, Dr. J Chattopadhyaya, and MVKV Prasad, Director ITR plus senior officials from DRDO and the armed forces.

BrahMos 2 hypersonic missile testing in 2017

The first prototype of the hypersonic cruise missile BrahMos 2, currently under development by Russian-Indian joint venture Brahmos Aerospace, is expected to be available for test flights in 2017. Speaking at an engineering technology forum near Moscow, BrahMos Aerospace CEO Sivathanu Pillai said that the company had already completed a series of laboratory tests of the missile at speeds of Mach 6.5.

"I think we will need about five years to develop the first fully-functional prototype of the hypersonic missile," Pillai said. He added that the missile would be manufactured in ground-launched, airborne and sea-launched modes, being scheduled to be supplied exclusively to India and Russia without additional worldwide exports.

Land-launched BrahMos I of the Indian Army

The development of the missile, with speeds in the range of Mach 5-Mach 7, was initiated by Brahmos Aerospace, a joint venture of Defence Research and Development Organisation (DRDO) and NPO Mashinostroyenia in 2011. Derived from the Russian-built P-800 Oniks/Yakhont supersonic anti-ship cruise missile, the BrahMos is a supersonic cruise missile designed for launch from land, ship, submarines and air platforms. Powered by a solid propellant rocket and possessing a liquid-fuelled ramjet to sustain supersonic cruise, the 290km range missile has a speed of Mach 2.8 and is capable of flying as low as 10m above the ground even in mountainous terrain.

The ground and ship-launched variants of the BrahMos have been successfully tested and inducted into service with the Indian Army and Navy, while the flight tests of the airborne version are expected to be complete by the end of 2012.

QR-SAM Procurements for the Indian Army

The Indian government has cleared the procurement of a massive $2.2-billion programme for quick-reaction surface-to-air missiles (QR-SAMs) to arm eight air defence regiments of the Indian Army. The missiles are to replace obsolete Soviet air defence systems of an earlier era (see photographc below).

MBDA are expected to offer the in-development Indo-French joint short-range surface to air missile (SR-SAM) or *Maitri* for the competition, in the hope that "enhanced synergies" will see a concept weapon get its big break even before it is fully operational.

The 9K35 Strela-10 of the Indian Army is a mobile visually aimed, optical/ infra-red guided, low-altitude, short-range surface to air missile system mounted on a tracked transporter-erecter-launcher (TELAR).

Also competing will be the Israeli Rafael-IAI SpyDer; an upgraded version of Raytheon's MIM-23 Hawk or modified SLAMRAAM and the Russian TOR M1 9M330. The Indian Army is looking for a QR-SAM system having reaction time of six seconds or less, with an engagement range of 9-15 km at altitudes of not less than 6 km or a weapon that delivers a single shot kill probability (SSKP) of at least 70% for a single missile fired, and 85% for a salvo shot involving two missiles.

The 2K12E Kvadrat (NATO SA-6) mobile surface-to-air missile system was supplied from the Soviet Union to the Indian Army for protection against low to medium level air attack.

The missile also needs to neutralise threats moving at slow speeds ranging from a hovering helicopter to very fast fighters (500 m/s). The Indian Army is examining missile systems that have ECCM capabilities and compatibility with systems currently in use.

C-130Js empennage to be manufactured by Tatas'

The Tata Advanced Systems unit at Hyderabad has been contracted to manufacture complete empennage units of Lockheed Martin C-130J Super Hercules and it is expected that this will be followed by increasing production of the aircraft leading to final assembly. Tatas' Hyderabad factory facility will become fully functional over the next year with Tata Advanced Systems having entered into a joint venture with Lockheed Martin. Six C-130J Super Hercules aircraft have been delivered to the Indian Air Force and more are likely to be ordered. The contract mandates LM to invest 30 per cent of the deal as offsets within the country.

"The factory will manufacture replacement centre wing boxes and tail sections for every new C-130J sold around the world. Beginning August, all C-130Js sold to any country will have parts built in Hyderabad," Lockheed Martin's India head Roger M Rose disclosed.

Tata Advanced Systems holds 74 per cent of the stake in the joint venture (JV) and Lockheed 26 per cent, the foreign direct investment (FDI) limit allowed in the defence sector. Tata Advanced Systems is a wholly-owned subsidiary of Tata Sons with focus on providing integrated solutions for aerospace, defence, homeland security and disaster management.

The factory is being set up in a special economic zone (SEZ) at Adibhatla near Hyderabad along with two other JVs. Tata Advanced Systems also has a JV with Sikorsky Aerospace Services to manufacture helicopter cabins with an investment of Rs 1,000 crore. That unit will manufacture cabins for all S-92 helicopters. Another JV with IAI of Israel named as NOVA has been allotted 30 acres land in the SEZ.

New HAL production unit near Bangalore

Hindustan Aeronautics Limited (HAL) plans to invest around Rs. 600 crores to establish a unit for manufacture of 'New Fighter Aircraft' and `Engine Production' (obviously the chosen M-MRCA and its power plant) at Chellaghatta, which is adjacent to HAL Airport in Bangalore. With the Karnataka Government supporting the growth and expansion of HAL in the State, a relevant MoU was signed between HAL and the Karnataka Government in June 2012.

"The new unit requires access to runway. It is a time-bound programme to establish the infrastructure, production facilities and supply of the aircraft", stated RK Tyagi, Chairman, HAL. The Company has around 40 acres of land at Chellaghatta, where this new Division for aircraft assembly and testing plus another for engine assembly and testing are proposed. The production facility will create direct employment for around 1200 personnel with another 3600 jobs expected to be created for logistics, services and outsourcing activities.

Dassault agreement with Taj Air

On 11 July during the Farnborough Air Show, Dassault Falcon signed an agreement with Indian charter operator Taj Air to establish a *Dassault Falcon Authorised Line Service Station* at Santa Cruz International Airport in Mumbai. The facility, which is already operational, will provide scheduled and unscheduled maintenance and inspections for all Falcon 2000 models. Initially, the facility will serve Indian-registered Falcons. EASA approval is expected early 2013.

Taj Air, a company of the Tata Group, will have a world class facility with 3,200 square meters (35,000 square feet) of hangar space and staffed by a team of trained professionals with broad experience in servicing aircraft. In addition to scheduled and unscheduled maintenance, AOG assistance is also available around the clock. Taj Air has invested significantly in tooling and training to support the new initiative and will eventually have 30 technicians dedicated specifically to Falcon aircraft.

"This agreement emphasises our philosophy of enhancing service experience by expanding our footprint of service," said Jacques Chauvet, Senior Vice President for Worldwide Customer Service for Dassault Falcon. "Asia and India are rapidly expanding as they realise the benefits of business aviation. Additionally, transient traffic in Mumbai continues to increase, so this agreement is of vital importance to all of our customers."

With Taj Air's approval, Dassault Falcon will be capable of servicing customers at 42 locations including 32 Authorised Service Centres, five company-owned Service Centres and five company-owned Satellite Service Centres. The service centre network is supported by 18 spare parts distribution facilities strategically located around the world, including at Mumbai and Chennai, plus a Technical Centre providing 24/7 support to Falcon operators across three time zones.

India to benefit greatly from new US defence export rules

India is projected to be one of the countries that would benefit from Pentagon's ambitious plan to reform rules and regulations related with defence exports. "Defence trade is a promising avenue for deepening security cooperation with our most capable partner nations. Our ongoing work in reforming our export control system is a critical part of fostering that cooperation and India is one such country that would benefit from changes to our system. My deputy, Ash Carter, will work with Indian counterparts to streamline our respective bureaucratic processes to better enable defence trade," stated US Defence Secretary Leon Panetta.

Bharat Electronics delivers EA-18G Growler subassembly

Boeing has recently completed the first EA-18G Growler electronic attack aircraft for the US Navy with a cockpit subassembly manufactured by Bangalore-based Bharat Electronics Limited (BEL). The subassembly provides cockpit floodlighting compatible with the aircraft's Night Vision Imaging System (NVIS).

Boeing had awarded BEL an initial contract in March 2011 for work on the Super Hornet cockpit subassemblies, with options of annual renewal for up to four years. Following BEL's demonstrated performance, Boeing recently exercised an option to renew the contract for another year. "BEL continues to demonstrate its capabilities and its position as a valued partner to Boeing," said Dennis Swanson, vice president of International Business Development for Boeing Defence, Space & Security in India. "BEL's work on P-8I, Super Hornets and Growlers is another example of how Indian companies are becoming a part of the global supply chain while Boeing helps them expand their opportunities across the global aerospace industry."

Other EA-18G parts produced by BEL include a complex-machined stowage panel for the Joint Helmet Mounted Cueing System connector cable and an avionics cooling system fan test switch panel with an NVIS-compatible floodlight assembly. Some of these cockpit subassemblies also will be installed on Boeing F/A-18E/F Super Hornets.

In addition to its F/A-18E/F and EA-18G work, BEL are to provide Identification Friend or Foe interrogators and Data Link II communications systems for the Indian Navy's fleet of P-8I maritime reconnaissance aircraft. Boeing and BEL are also partnered to establish the Analysis & Experimentation Centre in Bangalore.

Eurocopter reiterates commitment to Indian Market

Dr. Lutz Bertling, CEO of Eurocopter has reiterated Eurocopter's firm commitment to the Indian market despite the earlier cancellation and subsequent re-tendering of the Reconnaissance and Surveillance Helicopter (RSH) requirement for 197 light rotorcraft.

Dr. Bertling asserted that the AS550 C3 Fennec (see below) was "the leading contender owing to its proven hot/high performance and certified operational weapon system". He also highlighted the decades of experience in operating and building Cheetah and Chetak light helicopters at HAL. He was committed to extensive Transfer of Technology (ToT) for maintenance and parts manufacture within the country, as well as production of Fennec fuselages for Eurocopter's global market.

In addition to the RSH tender, he also drew focus on Eurocopter's plans to offer the Indian Navy and Coast Guard ship-based multirole AS565 MBe Naval Panther (a variant of the AS365 Dauphin) for maritime surveillance, search and rescue, offshore patrol, casevac and ASW/ASuW roles. For the Indian Coast Guard's expected shore-based medium helicopter requirement, Eurocopter will offer the EC725 Super Cougar, a maritime SAR variant of the AS332 Super Puma.

INS *Vikramaditya* commences sea trials

Sea trials have commenced of the Indian Navy's new aircraft carrier INS *Vikramaditya* after a major refurbishment costing $ 2.3 billion at the Sevmash Shipyard in Russia. Originally laid down in 1978 at the Nikolayev South Shipyard in Ukraine as the *Baku*, a modified *Kiev*-Class Project 1143.4 carrier, this was launched in 1982 and commissioned in 1987, while in 1991 she was renamed *Admiral Gorshkov*. In 1994, a boiler room explosion caused her to be withdrawn from service for a year undergoing repairs. She returned to service briefly in 1995 and in 1996 was taken out of service permanently and offered for sale.

Russian MiG-29 (Serial 311), which was hoisted on the carrier's deck before sailing out (note snow on deck)

The INS *Vikramaditya* has a displacement of 45,400 tonnes, an LOA of 283 m, beam 51 m and draft of 10 m. The propulsion system comprises eight oil-fired boilers with four GTZA 674 steam turbines delivering 50,000 hp to each of the four shafts. Maximum speed is 29 knots, cruising speed 18 knots, with a range of 13,800 nautical miles. The air wing is expected to consist of carrier-based MiG-29K/KUB fighters and Kamov Ka-28 ASW and Kamov Ka-31 AEW helicopters.

INS Vikramaditya at anchor in the White Sea

After leaving the Sevmash Shipyard the carrier sailed to the White Sea for a series of sea trials lasting 10 days. The ship then entered the Barents Sea for air wing trials with test flights, demonstrations of take off and landings, carried out with two Russian aircraft, the MiG-29K and the MiG-35, flown by Russian pilots.

INS Vikramaditya initial steaming during sea trials in the White Sea

Indigenous Aircraft Carrier construction delayed ?

According to reports, construction of the 40,000 tonne Indigenous Aircraft Carrier (IAC-1), being built at the Cochin Shipyard, has "slipped another three years.'' Reportedly, work on the approx one-third finished IAC, proposed to be called INS *Vikrant* after the country's first carrier which was decommissioned in 1997, is currently proceeding at "slow pace."

The IAC's keel was laid in February 2009, but the ship was prematurely floated out of the dry dock last December owing to delays in receipt of gear boxes and other systems. The initial contract for IAC, as sanctioned in 2002-2003, was for Rs 3,261 crore, but there is likely to be a major cost escalation.

As the 44,570-tonne INS *Vikramaditya*, or the refitted *Admiral Gorshkov*, will now be inducted by early-2013, under the revised $2.33 billion Indo- Russia contract, the Indian Navy will have to further stretch operational service of the lone 28,000-tonne INS *Viraat* to beyond 2014 with this carrier already over 50 years old. While the remaining Sea Harrier V/STOL fighters remain its only combat aircraft, the MiG-29K next generation fighters, being procured from Russia for $2 billion, can operate only from the INS *Vikramaditya* and the future IAC.

DCNS and Pipavav in strategic partnership

DCNS and Pipavav have established a strategic partnership for introducing DCNS technologies, methods and skills with Pipavav, India's largest private sector integrated defence company. The focus of the teaming is "to build the highest state of the art strategic assets including modern warships for the Indian Navy and Coast Guard".

Speaking on the partnership, Patrick Boissier, DCNS Chairman and CEO stated that, "Through the P75 Scorpene submarines, the on-going indigenisation programme and DCNS India, we are working to enlarge our footprint in India. This strategic partnership with Pipavav again demonstrates DCNS' confidence in the growing capabilities and long term development of the Indian defence industries".

Nikhil Gandhi, Pipavav Chairman declared "DCNS is well known for its high tech and very efficient platforms such as *Scorpene* submarines, *Mistral*-Class LPDs, FREMM frigates and innovative *Gowind* vessels (Corvettes and Offshore Patrol Vessels) among others. DCNS and Pipavav are to provide India with advanced expertise on naval ships. The synergies between India's largest integrated shipyard and the proficiency of the largest European naval defence company will allow cost effective and timely manufacturing of high class vessels for the benefit of all customers".

India and Japan bilateral maritime exercise *JIMEX 12*

The first bilateral maritime exercise between India and Japan, *JIMEX 12*, commenced on 9 June 2012 off Tokyo. Units of the Japanese Maritime Self Defence Force (JMSDF) which

INS Shivalik and INS Rana berthed together during their visit to south east Asia.

participated included two destroyers, one maritime patrol aircraft and a helicopter. Indian Naval units comprised the INS *Rana*, INS *Shivalik*, INS *Karmukh* and INS *Shakti*. The four ships entered Tokyo harbour on 5 June 2012 after visiting Singapore, Vietnam, the Philippines and Republic of Korea. The three-day stay in Tokyo coincided with commemoration of 60 years of diplomatic relations between India and Japan.

These four ships of the Indian Navy's Eastern Fleet under the command of Rear Admiral P Ajit Kumar, were on a sustained operational deployment to the South China Sea and North West Pacific. The two month long deployment which commenced in end-May 2012 enabled Navy-to-Navy cooperation with numerous navies across the region as well as demonstrated the Indian Navy's operational reach. On completion of the exercise, the ships visited Beijing, China and Port Kelang, Malaysia in mid-June 2012.

On completion of their four day visit to Shanghai, INS Shivalik and the PLA(N) Ma'anshan conducted passage exercises comprising naval manoueveres, communication exercises and cross deck helicopter landings.

The ships participated in passage exercises with the respective Navies of countries visited, the focus of 'Passage Exercises' primarily being in the sphere of Maritime Security Cooperation. These include Humanitarian Aid & Disaster Relief (HADR) operations and Visit, Board, Search and Seizure (VBSS) drills, which form a part of Anti-Piracy operations. Exercises of these nature enhance inter-operability thereby enabling the two navies to smoothly function together in the sphere of maritime security / HADR operations, should the need arise. In addition, during port visits, the Fleet Commander along with the Commanding Officers of the ships, met high-ranking officials of the navies, state administration, port management, coastal security organisations, police, and other stakeholders of maritime security in the countries visited. The Indian government has deployed ships of the Indian Navy on eastbound long range deployments in keeping with India's 'Look East' policy, to strengthen military ties with the countries of this strategically important region.

Indian Navy's operations in the Indian Ocean Region

The same four warships of the Indian Navy's Eastern Fleet later visited Shanghai in China for a four-day port visit. Even as the INS *Rana*, *Shivalik, Karmukh* and *Shakti* were on an operational deployment to the South China Sea and North West Pacific, another ship, the INS *Savitri* was at Port Victoria, Seychelles to participate in the National Day celebrations and thereafter be deployed for about two months to undertake surveillance of the Exclusive Economic Zones (EEZ) around Seychelles and Mauritius.

The Indian Navy continues to maintain a Dornier 228 MPA in the Seychelles (photograph above) to provide aerial surveillance of the EEZ, while another Dornier 228 remains active, operating from Maldives to meet that island nation's requirements for EEZ surveillance and on anti-piracy patrols.

Meanwhile, the stealth frigate INS *Tabar* continues its deployment in the Gulf of Aden on convoy escort and anti piracy patrol. The Western Fleet is set to deploy four ships on an overseas deployment to the Horn of Africa, Red Sea and the Western Mediterranean under command of Rear Admiral AR Karve, Flag Officer Commanding Western Fleet. Such long range deployments, covering the IOR and beyond, bear testimony to the blue water capabilities and operational readiness of the Indian Navy. During the recent Naval Commander's Conference, the Defence Minister Mr AK Antony had said "India's strategic location in the Indian Ocean and the professional capability of our Navy bestows upon us a natural ability to play a leading role in ensuring peace and stability in the Indian Ocean Region." He had also added that "Considering the challenges in the Indian Ocean Region, it is essential to maintain high levels of operational preparedness at all times."

Commissioning of ICGS Krishnapatnam

Coast Guard Station Krishnapatnam, the third Coast Guard Station in Andhra Pradesh, was commissioned on 18 June 2012 by Dr MM Pallam Raju, Minister of State for Defence. Establishment of the Station at Krishnapatnam is part of the ongoing efforts by the Coast Guard to strengthen coastal security in the coastal states.

Dr. MM Pallam Raju inspecting the Guard of Honour

The Station will function under the administrative and operational control of Commander, Coast Guard Region (East) through the Commander, Coast Guard District HQ-6 located at Visakhapatnam.

Dedicated cadre for Navy cyber cell

To combat the threat of cyber warfare and hacking into its computer systems, the Indian Navy is raising a dedicated cadre of officers who will be posted on all the 100 plus warships, including submarines, in order to make the Navy capable of operating in a network-centric environment that is totally dependent on inter-connectivity. Recruitment of the first batch of these officers as short service commission (SSC) officers in the executive branch (information technology) has commenced. They will get 22 weeks of training starting from December 2012 and will handle open-source applications and proprietary tailor-made software.

SpiceJet completes 7 years of operations

In completion of its seventh year of operations, SpiceJet Chief Executive Officer Neil Mills has said, "Our mission is to become India's preferred low-cost airline, delivering the lowest air fares with the highest consumer value to price sensitive consumers. We hope to fulfill everyone's dream of flying. We are thankful to all the thousands of flyers who prefer SpiceJet as their airline of choice."

SpiceJet Ltd began commercial operations on 23 May 2005 and today the airline has over 17% of market share in the domestic

market. SpiceJet operates 274 flights daily to 35 Indian cities and 2 international with a fleet of 32 Boeing 737-800 / 737-900ER as well as newly acquired Bombardier Q400 aircraft for enhancing connectivity to Tier II and Tier III cities (see photograph).

Airbus launches enhanced Customer Support Network in India

Airbus has launched an enhanced Customer Support Network in India which combines numerous individual Field Service support stations into one integrated team. Airbus will now have a continuous and extended Field Service presence, operating from two city hubs at Mumbai and Delhi, offering 24×7 regional support and services. Combined with Airbus Training India (ATI) and the Flight Operations Team in Bangalore, "Airbus' customers will now see an integrated team based in India," stated Didier Lux, EVP of Airbus Customer Services. "This initiative will pilot the way for a global deployment of this structure to enhance support coverage for all our customers."

In addition, a new position of Head of Airbus Field Service will be the local focal point for airline customers in the region

and will work closely with aviation authorities, manage on-site technical assistance teams and act as the primary communication interface between operators and Airbus' functions including programmes, maintenance & engineering, material logistics & suppliers, training and flight operations.

SpiceJet links Delhi with Kabul

On 13 July 2012, SpiceJet announced a further expansion of its network on the international circuit by introducing flights between New Delhi and the Afghan capital Kabul. The launch of Kabul services is a milestone for the airline as SpiceJet would be the sole private Indian carrier to operate services to Afghanistan.

The main runway at Kabul International Airport seen on approach.

Commercial flights will commence operations from 14 August 2012. Being a low-cost carrier, SpiceJet would be offering affordable air connectivity between the capital cities of India and Afghanistan.

Kabul is the fourth international destination for SpiceJet and the announcement comes within a fortnight of the launch of Dubai flights. SpiceJet currently operates to three international destinations with four routes: Delhi-Kathmandu, Chennai-Colombo, Delhi-Dubai and Mumbai-Dubai. In the Indian domestic market, SpiceJet connects 37 cities with a fleet of 47 aircraft that include Bombardier Q400 NextGen Turboprop and Boeing's 737 aircraft.

Bombardier Global 6000 in India on demonstration tour

Bombardier's Global 6000 with its new Vision Flight Deck was in India 1-7 July 2012 as part of its world tour. "The Global 6000 jet is receiving an astounding reception in India," stated Nilesh Pattanayak, Managing Director, South Asia, Bombardier Business Aircraft. "Indian customers are extremely discerning and they recognise that the Global 6000 aircraft offers the best in cabin technology, design and comfort. With this technology and design now extending to the cockpit with our Vision Flight Deck our customers are amazed at the jet's class-leading attributes, once again reaffirming Bombardier as the business aircraft leader in India."

The *Bombardier Business Aircraft Market Forecast*, published in June 2012, predicts business aviation industry deliveries of 1,345 aircraft in India for the 20-year period between 2012-2031.

Jet Airways' OnPoint Solution Agreement for CF6 Engines

On 9 July 2012, at the Farnborough Air Show, Jet Airways signed a 10-year OnPointSM solution agreement with GE Aviation, valued at $150 million, that expands the engine maintenance, repair and overhaul coverage to include new CF6-80E engines, which will power nine additional Airbus A330 aircraft that the carrier will begin inducting later in 2012. Jet Airways currently operates 10 A330-200 aircraft powered by CF6-80E engines that are covered with an OnPoint solution agreement from General Electric.

Jet Airways, along with its low cost brand, JetKonnect, is the largest airline in India with a modern jet fleet of GE90-powered Boeing 777-300ER, CFM56-powered Boeing 737 Next Generation and CF6-powered Airbus A330. It currently operates more than 600 flights a day to 55 Indian cities and 22 international destinations in the US, Europe, Middle East, SAARC and South East Asia.

OnPointSM solutions are flexible, long-term commitments designed to meet customers' unique engine service needs. Backed by GE's world-class support, "these solutions help lower our customers' cost-of-ownership and maximise the use of their assets. Available OnPointSM services include overhaul, on wing support, new and used serviceable parts, component repair, technology upgrades, engine leasing and diagnostics."

P&W and IndiGo contract for 300 PurePower PW1100G-JM engines

Pratt & Whitney and IndiGo have signed a definitive agreement for PurePower PW1100G-JM engines for 150 Airbus A320neo family aircraft, which includes 300 firm PurePower PW1100G-JM engines with additional options and a long-term PureSolutionSM maintenance agreement. Deliveries are scheduled to begin in 2015.

As part of this agreement, each IndiGo Airbus A320neo family aircraft will be powered by two PurePower PW1100G-JM engines with benefits "including double-digit reductions in fuel burn, environmental emissions, engine noise and operating costs when compared with current engines."

Pratt & Whitney has more than 2,500 PurePower engines on order, including options. The PurePower engine uses an advanced gear system allowing the engine's fan to operate at a different speed than the low-pressure compressor and turbine. The combination of the gear system and an all-new advanced core delivers double-digit improvements in fuel efficiency and environmental emissions as well as a 50 percent reduction in noise.

International airlines operating in India sue DIAL

Seven major international airlines operating out of India have challenged the steep increase in airport charges and are seeking to quash the April 2012 order passed by the airport economic regulator, terming DIAL's 334 per cent increase in airport tariff as "illegal". Lufthansa Group airlines (including Austrian and Swiss International), Air France, KLM, United and Virgin (which will resume India operations in winter) have filed a petition in the Delhi High Court. These airlines carry about 30 per cent of the outbound traffic from India.

Major international airlines have opposed this tariff hike proposal, terming it as "unnecessary", when the Airports Economic Regulatory Authority (AERA) had sought comments from the stakeholders in January. Some of the airlines had even expressed their apprehension that this tariff increase will make their operations "unviable" as profit margins are already wafer-thin on the fiercely price-sensitive Indian route.

Kingfisher Airlines' debts unlikely to be recovered

A full recovery of $1.4 billion in loans owed by Kingfisher Airlines was unlikely in the short term and banks have told the airline to infuse equity, according to Pratip Chaudhuri chairman of State Bank of India. He added that "It is looking difficult unless they get fresh equity. We have told Mallya either he has to get equity or pump in money from his liquor business."

Kingfisher Airlines, controlled by liquor baron Vijay Mallya, has gained more time from lenders to develop a turnaround plan. The airline has never made a profit in the struggling Indian airline industry and has lately grounded most of its fleet.

Air India pilots call off strike

Over 450 pilots of Air India, who fly international routes, have called off their agitation after 58 days making it one of the longest strikes in India's aviation history. The Air India management told the court it would "sympathetically" consider the reinstatement of the 101 sacked pilots, but did not give any assurance that all would be taken back.

This breakthrough, eventually, came on an intervention of the Delhi High Court when judge Reva Khetrapal asked Air India to adopt a "paternal attitude", and directed lawyers on both sides to arrive at a settlement. Air India's counsel Lalit Bhasin informed the court that the airline would, on withdrawal of strike, sympathetically consider all the grievances, including reinstatement of sacked pilots.

Dr. CP Ramanarayanan is Director Gas Turbine Research Establishment

Dr CP Ramanarayanan has been appointed as Director of Gas Turbine Research Establishment (GTRE), Bangalore and assumed office on 2 July 2012 but remains as Director VRDE. He had been Technology Director for thermal torpedo at National Science and Technological Laboratory (NSTL), Visakhapatnam and earlier was Project Director for thermal propulsion development for heavy and light weight torpedoes. He was instrumental for starting work indigenously for development of thermal propulsion system for torpedoes at NSTL.

Arun Mishra is new DGCA Chief

After the sudden exit of E K Bharat Bhushan as the Director DGCA, Arun Mishra, an IAS officer from the West Bengal cadre, has taken charge of the post. The civil aviation ministry is in the process of changing the qualifications for DGCA head as part of a wider overhaul of the regulatory regime for the aviation sector. DGCA itself is slated to be converted into the Civil Aviation Authority through an Act of Parliament.

NEW COMMAND APPOINTMENTS

General Bikram Singh takes over as Chief of the Indian Army

General Bikram Singh took over as the new Chief of the Army Staff on 31 May, succeeding General VK Singh who proceeded on superannuation. The change over of the baton was solemnised in a ceremony at the Army Chief's office.

The most decorated COAS in the history of independent India, General Bikram Singh PVSM, UYSM, AVSM, SM, VSM, ADC, is an alumnus of the National Defence Academy, and was commissioned into The Sikh Light Infantry in 1972. During his military career spanning over forty years, the General has held various high profile Command and Staff appointments. He has commanded an Infantry Battalion in the North East and on the Line of Control in J&K, a RR Sector and 10th Infantry Division in Northern Command. He has commanded XV Corps in the Kashmir Valley and then Eastern Command, headquartered at Kolkata. The General had earlier served in three UN Peace Keeping Missions.

General Bikram Singh also held important staff appointments at Army Headquarters, which included tenures in Military Operations, Perspective Planning and Staff Duties. Besides holding two Masters Degrees from India, he is also Masters in Strategic Defence Studies from the USA.

Vice Admiral DK Joshi appointed next Navy Chief

The appointment of Vice Admiral DK Joshi, presently Flag Officer Commanding-in-Chief, Western Naval Command, has been announced as the next Chief of the Naval Staff with effect from 31 August, 2012, taking over from Admiral NK Verma.

Born on 4 July 1954, Vice Admiral Joshi was commissioned on 1 April 1974 in the Executive Branch of the Indian Navy. During his long and distinguished service spanning nearly 38 years, the Vice Admiral has served in a variety of Command, Staff and Instructional appointments. His sea command includes that of the guided missile corvette INS *Kuthar*, guided missile destroyer INS *Ranvir* and the aircraft carrier INS *Viraat*. Before taking over as FOC-in-C Western Naval Command, he served as Deputy Chief of Naval Staff, Commander-in-Chief of A&N Command (CINCAN) and as the Chief of Integrated Defence Staff to Chairman, Chiefs of Staff Committee (CISC).

Vice Admiral Joshi is a graduate of the Naval War College, USA, an alumnus of the College of Naval Warfare, Mumbai and the National Defence College. He was Defence Advisor in the Indian High Commission at Singapore from 1996 to 1999.

Air Marshal Arup Raha is AOC-in-C Western Air Command

Air Marshal Arup Raha has taken over as AOC-in-C, Western Air Command in New Delhi, and was earlier AOC-in-C Central Air Command at Allahabad.

Air Marshal Raha was commissioned in the IAF in December 1974 and has to his credit nearly 3400 hours of flying, mainly on fighter aircraft. An experienced Qualified Flying Instructor, the Air Marshal has served as Directing Staff at the Flying Instructors School, (FIS), Tambaram as well as at the Tactics and Combat Development Establishment (TACDE), Gwalior.

From 1999 to 2001, Air Marshal Raha served as Military and Air Attaché at the Indian Embassy in Kiev, Ukraine. His operational assignments include the command of a MiG-29 squadron (No.47) and later was Station Commander Air Force Station, Bathinda in Punjab during Operation 'Parakram', and as Deputy Commandant of the Hyderabad-based Air Force Academy.

Air Marshal Arup Raha inspecting the Guard of Honour at Subroto Park, Headquarters of Wesern Air Command.

Air Marshal DC Kumaria is Vice Chief of the Air Staff

Air Marshal DC Kumaria, who was earlier Air Officer Commanding-in-Chief, Western Air Command, assumed charge as the new Vice Chief of the Air Staff (VCAS) at Air Headquarters on 1 June 2012.

A graduate of the Defence Services Staff College (DSSC) Wellington, the Air Marshal has held various important Field and Staff appointments, commanding No.6 Maritime Strike Jaguar Squadron and a major fighter base, where he was responsible for operationalisation of mid air refueling. The Air Marshal was earlier Staff Officer to the Chief of the Air Staff and Air I at Headquarters, Western Air Command and Principal Director of Concept Studies at Air Headquarters where he authored the *Air Power Doctrine* of the Indian Air Force. He was first Assistant Chief of the Air Staff Operations (Space) at Air Headquarters and on elevation to the rank of Air Marshal was appointed as the first Director General Air (Operations) at Air Headquarters. He was Senior Air Staff Officer (SASO) at South Western Air Command prior to taking over as C-in-C of Western Air Command.

Air Marshal Kumaria has flown all variants of the MiG-21 and was among the first batch of fighter pilots to convert on Jaguars in the United Kingdom. He also underwent the Qualified Weapon Instructor (QWI) Course in the UK, as well as the Instrument Rating Instructor and Examiner (IRIE) and the Fighter Combat Leader (FCL) Course, followed by a tenure as a member of Directing Staff at the Tactics and Combat Development Establishment (TACDE) at Gwalior.

The Air Marshal's foreign assignments include serving as Assistant Defence Advisor (Air) at the Indian High Commission in Dhaka, and as Defence Attaché at the Indian Embassy in Rome with concurrent accreditation to the Iberian countries.

Chief of the Air Staff Air Chief Marshal NAK Browne greeting Air Marshal DC Kumaria at Air HQ.

Lt Gen Dalbir Singh Suhag appointed GOC-in-C, Eastern Command

Lt Gen Dalbir Singh has taken over as GOC-in-C of Eastern Command at Kolkata, having earlier been GOC of the Dimapur-based III Corps.

Lt Gen Dalbir Singh was commissioned in June 1974 into the 4th Battalion of the 5th Gorkha Rifles (FF) and is also Colonel of this highly decorated Regiment.

In his 38-year career the Lt General has seen operational service in J&K high altitude areas, and counter insurgency

in Sri Lanka (*Operation Pawan*). He commanded a Rashtriya Rifles Battalion in Nagaland, an Infantry Brigade in J & K and later was GOC of 8th Mountain Division in the Kargil-Dras Sector.

Apart from tenures as an Instructor at ASMT (Army School of Mechanical Transport), at the IMA and as a Col Q (Ops) in a Corps HQ, he has also served both as Director and later as Deputy Director General, in the Staff Duties (SD) Directorate at Army HQ. His other important Staff Appointments include Chief of Staff at XVI Corps (Nagrota) and Inspector General of the Special Frontier Force.

Lt General Sanjiv Chachra is GOC-in-C Western Command

Lt Gen Sanjiv Chachra took over as GOC-in-C, Western Command, at Chandimandir on 1 June 2012. Earlier, Lt Gen Chachra was serving as Military Secretary at Army Headquarters.

An alumnus of the National Defence Academy, and a second generation Rajput Regiment Officer, Lt Gen Chachra was commissioned in 17 Rajput in June 1974 and later commanded 16 Rajput in a counter insurgency environment in the North-East.

Lt Gen Chachra has had a distinguished combat experience and has seen active service on the Siachen Glacier and other high altitude areas in the North and North-East. He has commanded a vital pivot corps in the semi-desert sector, where he was instrumental in conceptualising the transformation of operations to meet challenges of the future.

Besides tenures in the Military Operations and Military Training Directorates at Army Headquarters, he served as a Military Observer with the UN Peace Keeping Mission for the independence of Namibia in 1989.

Air Marshal Jasvinder Chauhan is AOC-in-C Central Air Command

Air Marshal Jasvinder Chauhan has taken over as AOC-in-C of Central Air Command (CAC). Earlier, he was Senior Air Staff Officer (SASO) at Southern Air Command.

A graduate of the National Defence Academy, Air Marshal Chauhan was commissioned into the IAF as a fighter pilot in June 1975 and has over 3500 hours flying hours to his credit on various types of fighter, helicopter and trainer aircraft. He is an alumnus of the Air Command and Staff College in the USA and has commanded a frontline fighter squadron, an Air Defence Direction Centre and a premier fighter base.

The Air Marshal was earlier Air Attache in Moscow.

Air Marshal Jasvinder Chauhan, Air Officer Commanding-in-Chief Central Air Command, Allahabad with his Principal Staff Officers

Vice Admiral Satish Soni is FOC-in-C Southern Naval Command

Vice Admiral Satish Soni assumed office as Flag Officer Commanding-in-Chief, Southern Naval Command at Kochi on 31 May, succeeding Vice Admiral KN Sushil.

Vice Admiral Satish Soni was commissioned into the Navy in July 1976. Awarded the 'Sword of Honour' and a specialist in Navigation and Aircraft Direction, the Admiral's important sea commands include those of stealth frigate INS *Talwar*, guided missile destroyer INS *Delhi*, missile corvette INS *Kirpan* and the eastern fleet. Vice Admiral Soni has also been Chief of Staff of Eastern Naval Command and Commandant of the National Defence Academy at Khadakwasla, Pune.

Vice Admiral Satish Soni inspecting the parade accompanied by his predecessor, Vice Admiral KN Sushil

Vice Admiral Pradeep Chatterjee takes over as DCNS

Vice Admiral Pradeep K Chatterjee, AVSM, NM, has taken over as the Deputy Chief of Naval Staff at the Integrated Headquarters Ministry of Defence (Navy).

Commissioned in January 1977, the Flag Officer specialised as a submariner, and went on to command the *Shishumar*-class (Type 1500) submarines, INS *Shankush* and INS *Shankul*, the latter of which he commissioned. His ship commands include the training Ship INS *Krishna*, and guided missile destroyer, INS *Rajput*. He has held various senior Staff appointments such as Commodore Commanding Submarine (West), COMCOS(W) at Mumbai; Principal Director Submarine Operation (PDSMO) and Principal Director Submarine Acquisition (PDSMAQ) at Naval Headquarters. In the Flag rank he has held the posts of Flag Officer Submarines (FOSM) at Visakhapatnam, Flag Officer Maharashtra and Gujarat naval Area (FOMAG) at Mumbai, and Inspector General Nuclear Safety (IGNS) at Naval Headquarters, New Delhi.

Interestingly Vice Admiral Chatterjee becomes the first submariner at the helm of Operations Branch of the Indian Navy and at a time when the Indian Navy is on threshold of integrating a nuclear attack submarine INS *Chakra* and inducting a nuclear ballistic missile submarine, the indigenously built INS *Arihant*.

Air Marshal Paramjit Singh Gill is SASO, Western Air Command

An alumnus of National Defence Academy, he was commissioned in 1975 in the fighter stream and has more than 1000 hrs of instructional flying and about 4000 hrs of total flying, initially on Gnat light fighters and then the swing-wing MiG-23BN.

He is a Qualified Flying Instructor (QFI), holding A2 instructional category and has served as Directing Staff at the Flying Instructors School, Tambram, was Chief Instructor (CI) at Air Force Station, Bidar. Later Commandant College of

Air Warfare, Secunderabad, he also commanded the Tactical Air Centre (TAC) at Ambala; Air Force Station, Wadsar and was Air Officer Commanding, AF Station Kalaikunda. He has held appointments of Asst. Chief of Integrated Staff (Joint Operations), ACIDS (Jt Ops), at HQ IDS. He has been Air Officer Commanding, J&K Area and was SASO, CAC since August 2011 before assuming his present appointment as SASO, WAC.

The Indian Army's 25th Chief

On 1 June 2012, the day General Bikram Singh, 25th head of the Indian Army assumed office, Major General Ashok Mehta wrote on the

"Task cut out for new COAS"

"Thank God it's Friday (June 1)!" This is a special day for Defence Minister, AK Antony. No longer does Munna, his peon have to tear off dates from a special calendar in Antony's office.

Thank God the tension is over, sighs Munna, referring to the cataclysmic tenure of Gen VK Singh who has demitted office. Prime Minister Nehru had little time for Generals though he did fear two: Gens KM Cariappa and KS Thimayya, whom he imagined were planning a coup. Mrs Indira Gandhi, according to Field Marshal Sam Manekshaw used to tease him about a 'take over' after the creation of Bangladesh. This bogey of a coup has also drawn in General VK Singh — about the 'unauthorised troop movements which had to be stopped', according to a high national security official. No one will know what was on that General's mind when movement of Special Forces was ordered on the eve of his going to court. Just a coincidence, perhaps?

General VK Singh's tenure (according to his calculation, illegally truncated) surpasses all his 23 predecessors in terms of flap and controversy with negatives trumping the positives of his contribution. That he succeeded in going as far as he did till almost the last day in service without a demur from the Government will remain a blot on the establishment, more regrettably, the office of the COAS. Gen VK Singh ran wild under the delusion that he was leading a crusade for the Army when it was plain and simple self before service. Sadly for him, his love affair with himself has ended. The shouting brigade he had mobilised for television channels deserted him some time ago.

His legacy will be one of breaching three eternal taboos of the Army: of dividing, politicising and communalising it, especially the officer class. The media that he nurtured proved to be his nemesis. Far from cleansing the internal health of the Army that he had set out to do, he administered the wrong antidote.

Welcome, Gen Bikram Singh ! Your task is not a simple one. You take over an office sullied by the events of the past one year by a predecessor who did his best to prevent not just you but your likely successor, Lt Gen Dalbir Singh from occupying the exalted office. Please put a lid on targeting the chain of succession and forgive and forget. A damage assessment from recent events that hurt the internal health of the Army will be useful for a roadmap for the future. Your own reputation has been besmirched by misguided but professional Public Interest Litigators. But your record speaks for itself.

Three eventful tenures in UN Peacekeeping Operations especially the delicate handling of forces in the Congo, the brave tenures in J&K fighting terrorists and being wounded and the quiet Bikram stamp over Eastern Command which you left behind… no one has forgotten your daily commentaries with crisp assessments on the Kargil battle in 1999.

You come at a difficult time when a healing touch is required. With you at the helm today, a new era should begin for which many have been counting the days. In a corner of St James's Square in Pall Mall London is a 330-year old military club which has portraits of the illustrious like Lord Nelson and Duke of Wellington. They came and went. The name of the Club is In and Out.

Finally, remember the Roman proverb: *Ubi Concordia Ibi Victoria* – where there is unity, there is victory.

Brigadier (R) Gurmeet S. Kanwal writes on :

Agenda for the new chief

General Bikram Singh has taken over the reins of the Indian Army at a time when this great army – often referred to as the 'last man standing' – is passing through a rough patch in its history. The higher leadership of the army has been facing criticism for putting 'self' before 'service', contrary to the Chetwood motto that is ingrained into an officer's psyche while undergoing training at the Indian Military Academy (IMA), Dehradun: *"The safety, honour and welfare of your country come first, always and every time. The honour, welfare and comfort of the men you command come next.*

Your own ease, comfort and safety come last, always and every time." (From a speech delivered by Field Marshal Sir Philip W Chetwood during the inauguration of IMA in 1932.)

General Bikram Singh, COAS with Mr. A.K. Antony, Defence Minister of India.

The latter half of General V K Singh's tenure as COAS was marred by unseemly controversies that have dented image of the army as a first class fighting force. These controversies are too well known and too recent to bear recounting.

While individually none of them have amounted to much, collectively these have severely undermined the reputation of the army in the eyes of the public. In this mega-media age, the army's image has also taken a hit internationally.

A dispassionate SWOT (strengths, weaknesses, opportunities, threats) analysis reveals that up to the level of combat units, that is infantry battalions, armoured and artillery regiments and other arms and services, the army continues to remain a first rate fighting force. The combat-level army is as cohesive a fighting force as it has ever been and its operational ethos is marked by professional excellence and devotion to the nation well beyond the cause of duty. In this regard, the armed forces are the only organ of the state that is worthy of the nation's trust.

However, a small number of officers comprising the army's leadership ranks from brigadier onwards appear to have lost their moral compass and strayed in their approach from right to wrong. These officers have been involved in dubious and shady ventures, such as faction fights and land and housing scams. They have quite obviously failed in their judgment of what constitutes impropriety.

These officers have apparently forgotten the line in the prayer of the National Defence Academy, Khadakvasla, that exhorts officers to choose 'the harder right, instead of the easier wrong.' Perhaps they have fallen victim to the ills that plague India's civil society, which spawns them.

This is a serious development with grave long-term consequences for the army's operational ethos. The armed forces have always held their officers to higher moral standards than the civil society that they come from. Immediately corrective action must be taken to put an end to declining moral standards. General Bikram Singh enjoys an excellent reputation as a professional soldier and will no doubt lead by personal example to arrest and correct the downslide in the moral standards of the army's higher ranks. Restoring trust of the nation in the army and confidence of the soldiers merit his highest consideration in the months ahead.

The new COAS must simultaneously take stock of the army's preparedness for war and internal security challenges. General VK Singh's leaked letter to the prime minister spoke of 'critical hollowness'. The CAG's recent report revealed that the state of defence preparedness is a cause for serious concern. Parliament's standing committee on defence has noted these developments with concern.

Weapons, ammunition and equipment shortages have persisted for long and several chiefs before General VK Singh had written to the prime minister and the defence minister for help to remove these. During the Kargil conflict the nation had heard the then COAS, General VP Malik, make the chilling statement on national TV, "We will fight with what we have."

Another issue that needs the chief's immediate attention is the continuation in service of obsolescent weapons and equipment well past their operational life and the stagnation in the process of military modernisation aimed at upgrading the army's war-fighting capabilities to prepare it to fight and win on the battlefields of the 21st century. Among other areas, he will need to concentrate on upgrading the artillery's firepower potential, the 'night blindness' of the army's infantry battalions and mechanised forces, and the fact that the air defence guns and missile systems are almost completely obsolescent. Simultaneously, he must also help the MoD to restore civil-military relations to a healthy level.

Perceptions matter and the new chief must take action transparently on recent cases of indiscipline, corruption and 'botched up' counter-insurgency operations. Only then will the nation's faith and confidence in the army's war-fighting capability be restored.

The 1000+ Helicopter Plan

India's massive rotorcraft requirement

HAL Dhruv ALHs of the Indian Army in Ladakh.

With the massive push for modernisation across all branches of India's armed forces, it comes as little surprise that rotary-wing aviation is slated to see enormous growth over the next decade. Across the Indian Army, Navy, Air Force and Coast Guard, the market for helicopters in India is projected to be over one thousand units for the armed forces and an undetermined number for the civil market !

As for the Army, there are major policy decisions to be expected in the near future. One of the key matters reportedly discussed between the new COAS, General Bikram Singh and Defence Minister AK Antony on 2 July was the acquisition of 'combat air assets' which are integral part of the plans to provide 'more teeth to strike formations'. This is relevant to the major policy shift regarding Army Aviation, with plans to equip each of the strike corps (I Corps

at Mathura, II Corps at Ambala and XXI Corps at Bhopal) with aviation brigades consisting of attack, reconnaissance and utility helicopters.

Additionally, there are plans to raise dedicated combat helicopter squadrons for close air support and anti-tank roles. The rationale behind this dramatic change in doctrine is to give Army Commanders added resources and the flexibility to employ these in real time under their command. At present, all Indian dedicated attack and assault / utility helicopters are with the Air Force, which deploys them on need-basis as per Army requirements.

Not surprisingly, this new effort by the Army has triggered off a fresh 'stand off' between the Indian Army and Air

HAL Lancer, based on the Cheetah.

Boeing AH-64D Apache Longbow (Block III)

The latest iteration of the tried-and-tested AH-64 Apache line, the Block III gains more powerful T700-GE-701D engines producing 2000-horsepower along with improved digital connectivity, composite rotor blades, full IFR capability, improved landing gear and even the ability to control UAVs. It retains the Longbow millimetre-wave fire-control radar from the base AH-64D variant.

With a maximum takeoff weight of around 10,500 kg, the Apache carries a formidable array of weaponry, including a 30x113mm M230 chain gun with 1,200 rounds, and six weapon stations on the stub wings for a mix of weaponry ranging from Hydra or CRV7 rocket pods, AGM-114 Hellfire missiles, and AIM-92 air-to-air Stinger missiles.

Mil Mi-28NE 'Havoc'

The Mi-28N is Russia's primary all-weather attack helicopter, and is a more purpose-built craft for that role than either the Mi-24 or Mi-35, which were both designed with a secondary troop transport capability. The Mi-28 does have the ability to carry 3 passengers, in order to facilitate the rescue of downed airmen if a situation demands it. It is powered by a pair of Isotov (now Klimov) TV3-117VMA turboshaft engines producing 2,500 horsepower, linked to a 5-bladed main rotor and a narrow X-type tail rotor. The Mi-28N also has a FLIR sensor and rotormast-mounted millimetre-wave radar.

The armament consists of a nose-mounted Shipunov 2A42 autocannon firing 30x165mm ammunition, along with four pylons on stub wings, with the ability to carry S-8 or S-13 rocket pods, 9M114 Shturm (AT-6 Spiral) anti-tank missiles, Igla-V (SA-16 Gimlet) air-to-air missiles, or Vympel R-73 (AA-11 Archer) air-to-air missiles.

Mil Mi-26 'Halo'

The Mil Mi-26 needs little introduction: it is the world's largest and most powerful production helicopter and has been used for everything from tactical airlift to disaster relief across the globe. Twin Lotarev D-136 turboshafts producing a gargantuan 11,400 horsepower each power an eight-bladed main rotor, giving the helicopter the ability to carry up to 90 troops or 20 tonnes of cargo.

The Mi-26 is already in service with the IAF but the airframes are old and maintenance-intensive, making the type ready for replacement.

Force and makes even more urgent the need to implement the Naresh Chandra Committee recommendations submitted to the Government in May 2012 (see 'Commentary') for a Chief of Defence Staff, under whatever designation this appointment is finally known.

At present, the Indian Air Force is the largest operator of rotorcraft in the country. Notwithstanding the M-MRCA programme, which was resolved earlier this year with selection of the Dassault Rafale, even as the Sukhoi-HAL FGFA programme is on stream and DRDO's LCA Mk.II and AMCA development plans are in the spotlight, there are over 400 helicopters to be inducted into the Air Force over the coming years as well.

In *Vayu* Issue II/2012 was covered induction of the first Mi-17V5 medium utility helicopters, for which the contract stands at 80 units with an option for a further 59 that is likely to be exercised. The first 80 helicopters were ordered in 2008 at a cost of $1.4bn and the additional 59 are to cost another $1bn. The Mi-17V5 is a variant of the Mi-8 family of helicopters already operated by Russia. The new helicopter features a higher operating altitude and payload thanks to more powerful engines, along with a weather radar in the nose and a rear loading ramp to facilitate rapid ingress and egress of troops as well as cargo.

In addition to medium lift helicopters, the IAF is looking to augment capacity across all payload paradigms, with the induction of new light utility and heavy-lift helicopters as well. To replace its

MiL Mi-35s of the IAF.

aging fleet of Mi-26 heavy-lift helicopters, the Air Force has conducted trials of the Boeing CH-47F Chinook tandem-rotor helicopter for a contract worth approximately $600m for 15 units. Despite a lower payload than the Mi-26, also in competition, the more modern avionics suite, lower projected maintenance costs and higher operating altitude make the Chinook an attractive option. This type can deliver 50 fully-equipped troops onto a rooftop or cliff's edge and has been extensively battle-tested from the Vietnam War era through to the present with a series of modernisations.

Additionally, while the well-publicised deal for 12 AgustaWestland AW101 VIP transport helicopters remains intact despite some controversies, the first helicopter is due to be delivered by October this year. The deal is worth $700m and the three-engined AW101 will supplant the Mi-8/17s operated by the Air Headquarters Communication Squadron at Palam Airport.

On the combat helicopter front, close to $3billion will be spent on acquiring new types to replace the present Mi-25/35s operated by two Squadrons. The requirement is for 22 dedicated attack

Boeing CH-47F Chinook

The CH-47F Chinook is one of the latest developments of the CH-47 family, which had its genesis in the Vietnam War and first flew in 1962. The type has been continuously developed since its inception and the CH-47F brings a number of notable changes to the preceding 'D' model – featuring larger single-piece sections in the airframe, improved avionics and new 4,800 horsepower Honeywell T55-GA-714A turboshaft engines. The new construction techniques will reduce maintenance frequency and cost and increase service life of the helicopter.

The Chinook can transport 30-50 troops with various levels of equipment or about 12.5 tonnes of cargo. It also has the ability to mount three 7.62x51mm M240 machineguns on pintle mounts at the shoulder windows and loading ramp. It is already in service with the US Army, and will be delivered to export customers including the UK, Australia, Canada and the Netherlands.

Eurocopter AS550 C3 Fennec

The AS550 is a military development of the Eurocopter AS350 Ecureuil and serves as a lightweight, multipurpose single-engine military helicopter. The Turbomeca Arriel 2D engine produces 840 horsepower, giving the helicopter excellent hot and high performance, and the Fennec is operational up to 7,000m and 50°C.

As an armed reconnaissance and surveillance helicopter, there are provisions for a variety of armament ranging from a 20x102mm Nexter M621 cannon pod, to 7.62x51m or 12.7mm machinegun pods, and BGM-71 TOW anti-tank missiles, as well as rocket pods.

helicopters, with Boeing's AH-64D Block III Apache Longbow and Russia's Mil Mi-28NE 'Havoc' as contenders for the order, said to be worth around $1.4 billion. It is learnt that after technical and flight evaluations, the Apache has emerged "ahead" of the Havoc and possibly lack of Mi-28 operators outside Russia will have an impact on the consideration of the type by Indian decision-makers.

In parallel is HAL's in-country development of the Light Combat Helicopter (LCH) which will form the bulk of inventory, with 65 units intended to be procured at a total cost of $1.4 billion.

Surely the most proliferant helicopter type in Indian skies will be the HAL Dhruv Advanced Light Helicopter with over 300 to be acquired by the armed forces, including the Coast Guard. The Army and Air Force will both induct large numbers of Dhruv units in the utility role, with some 54 of those being the armed 'Rudra' variant (also called Dhruv-WSI, or Weapons Systems Integrated) as ordered by the Army.

The venerable HAL Cheetah (Aérospatiale Lama) and HAL Chetak (Aérospatiale Alouette III) employed for many decades in high-altitude regions

Kamov Ka-226T 'Sergei'

The Kamov Ka-226T is a twin-engine multipurpose utility helicopter in the 3-tonne class, featuring Kamov's trademark co-axial rotors of an advanced composite construction, eliminating the need for a tail rotor and making the helicopter highly manoeuvrable. While the base Ka-226 uses Rolls-Royce Allison 250C turboshafts producing 450 horsepower each, the Ka-226T instead uses Turbomeca Arrius 2G engines providing 670 horsepower each, to better optimise it for use in hot and high environments.

The helicopter lacks a traditional cabin and can instead be configured with a selection of 'mission modules' suiting a variety of roles. However, it lacks the multitude of armament options that are present on the AS550 Fennec.

IAF Mi-17V5 over the lower Himalayas.

IAI Lahav

Sikorsky S-70B Sea Hawk

The S-70B Seahawk is a maritime development of the ubiquitous land-based utility helicopter, the US Army's UH-60 Black Hawk. Featuring navalised GE T700 turboshafts producing 1,800 horsepower, changes made from the Black Hawk include lateral pylons for torpedoes or fuel tanks, external winch for SAR applications, undernose search radar, 25-tube sonobuoy launcher and a towed magnetic anomaly detector. It can carry 1,400kg loads within the cabin or 2,700kg on an external sling. The cabin can accommodate 5 passengers.

In addition to Mk46 and Mk50 torpedoes, the S-70B can also carry the Kongsberg AGM-119 Penguin anti-ship missile as well as the AGM-114 Hellfire missile. In addition it can equip a .50 calibre or 7.64x51mm machinegun, or a 7.62x51mm gatling gun.

including the Siachen Glacier, have to be urgently replaced. There have been several rounds of evaluation over the past decade including those at extreme altitude and the continuous delays have impacted on both the ability to support of land forces and credibility of the decision making processes. The requirement is for 197 reconnaissance & surveillance helicopters for a value of some $2 billion. Of these, 137 are intended for the Army, and the remaining 60 for the Air Force.

After Bell helicopters opted out, it has again come to pass that Eurocopter's AS550 C3 Fennec is the "logical choice" to replace the earlier Aérospatiale designs, given that Aérospatiale merged with DiamlerBenz Aerospace (DASA) in 1992 to form Eurocopter. The Fennec is in service with a number of forces across the globe, including France, Brazil, Malaysia, Mexico and Thailand. It is positioned as the "reference helicopter" for hot-and-high operations, having operated from atop Mt.Everest in 2005. However, Russian helicopter manufacturer Kamov hopes that its co-axial rotor Ka-226T 'Sergei' will be considered favourably but the fact

Indian Army Aviation has ordered a large number of HAL Dhruv ALHs.

Boeing

that it is operated only in Russia (with a confirmed sale made to Jordan) might sully its chances.

Whichever manufacturer gets the order will have significant offset and transfer of technology obligations, with only the first batch of 67 aircraft to be procured externally and the rest manufactured in-country. Meanwhile, HAL is continuing with development of its own light utility helicopter (LUH) for which a requirement of 187 numbers is stated.

In line with the paradigm shift in Army Aviation mentioned earlier, this Service will also acquire 114 HAL Light Combat Helicopters to provide an airborne offensive capability to augment ground movements. Featuring the same engine, rotors and gearbox as the Dhruv, the LCH aims to marry HAL's experience gained from the Dhruv to the Army's requirements for combat aviation elements as part of future operations. The LCH will be particularly useful in high-altitude areas where contemporary attack helicopters have difficulty in operating.

Lockheed Martin MH-60R Seahawk

Based on the same UH-60 platform as the Sikorsky S-70B, the MH-60R multi-mission helicopter (commonly referred to as the 'Romeo' in reference to the variant letter), is marketed by Lockheed Martin since they are the primary systems integrator. It is equipped for a range of missions including ASW, ASuW, SAR, naval gunfire support (NGFS), surveillance, communications relay, vertical replenishment and personnel transfer.

With a similar engine and weapons fit as the S-70B on offer from Sikorsky, the MH-60R distinguishes itself from its cousin with a completely new avionics suite, multi-spectral targeting system FLIR sensor (MTS-FLIR), and an advanced airborne active sonar – the AN/AQS-22 airborne low-frequency dipping sonar (ALFS).

Elisra

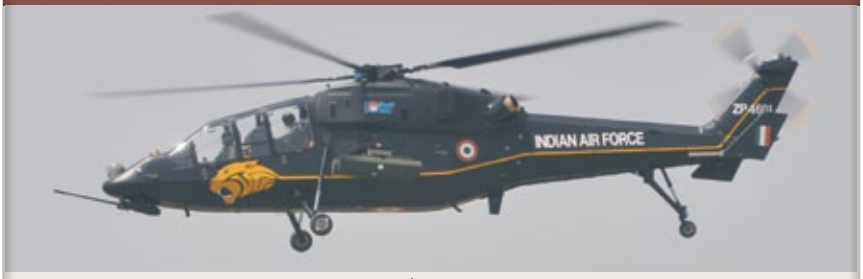
AgustaWestland AW101 Merlin

Computer-generated image of AW101 in IAF VIP transport colour scheme

The AW101 Merlin began life as a joint British-Italian programme to replace the Naval Sea Kings of both those countries. The helicopter soon saw wider use across the globe, in countries such as Canada, Denmark, Japan and Portugal. It is primarily used in military service as a medium transport, ASW or SAR helicopter, but can also be configured for VIP transport.

The AW101 has three turboshaft engines powering a 5-blade composite main rotor with a unique design meant to increase efficiency and reduce noise. Engine choices are the GE CT7 turboshaft producing 2,500 horsepower per engine, or the Rolls-Royce Turbomeca RTM322 producing 2,100 horsepower per engine. When configured for the VIP transport role, the AW101 has a range in excess of 1,300km and cruises at almost 300km/h. A unique feature of the AW101 that makes it suitable for VIP transport is the high tail boom, allowing ground vehicles to directly approach the rear entry door so as to reduce passenger exposure to threats.

HAL LCH



The HAL Light Combat Helicopter (sometimes referred to as the 'Tigerbird,' although it has not been officially named as yet) was developed to address the lack of an attack helicopter capable of operating in the high altitudes of areas such as Kargil.

It draws on HAL's knowledgebase formed during the development of the Dhruv, and incorporates the same engines in a redesigned fuselage. The airframe is long and narrow, and the crew sit one behind the other as opposed to side-by-side in the Dhruv. It is designed to operate reliably at altitudes up to 6,500 metres and is optimised for the anti-armour and anti-personnel roles, with secondary counter-insurgency (COIN), suppression of enemy air defence (SEAD), and armed reconnaissance functions.

Armament includes a M621 20x102mm autocannon in a Nexter turret, along with a variety of air-to-air and air-to-ground stores such as 60mm and 80mm rockets, guided missiles and gravity bombs.

The Army has also projected for a further requirement of 60 'tactical battle support' helicopters in the 10-12 tonne class, but this requirement is obviously being contested by the Indian Air Force. Such helicopters are required to "swiftly and precisely transport troops in a tactical scenario". Helicopters in this role/weight class include the Boeing CH-47 Chinook, Sikorsky UH-60 Black Hawk and S-92 Superhawk, NHI NH90, Eurocopter EC725 and the Mil Mi-17, in the main.

On the maritime front, two large contracts are in the offing, one for 91 naval multi-role shipborne helicopters (MRSH) and the other for 56 naval utility helicopters (NUH). The large

MRSH procurement will supplement the Navy's obsolescent and aging fleet of Westland Sea King 42 anti-submarine warfare (ASW) helicopters. Less than thirty Sea Kings remain operational, making the MRSH an urgent requirement for the Navy. Vying for the order are Sikorsky with their S-70B Seahawk, a naval variant of the ubiquitous UH-60 Black Hawk that can be configured for a variety of roles such as ASW, ASuW, search and rescue (SAR) and medical evacuation (MEDEVAC); Lockheed Martin, with the MH-60R (a Sikorsky SH-60 airframe with a number of additional systems integrated by Lockheed, including greater offensive capability) and NH Industries with their NH90 multi-role utility helicopter.

The NUH tender specifies the need for a 4.5 tonne, twin-engine helicopter optimised for shipboard operations, which are intended to replace the Navy's HAL Chetaks now nearing the end of their service lives. The order is projected to be worth over $800 million, and vendors who have responded to the RFI include Eurocopter, AgustaWestland, Kamov, Sikorsky and Bell. Eurocopter has indicated their participation with the AS565 Panther, a militarised variant of the widely-used AS365 Dauphin helicopter. AgustaWestland could enter with the AW109 Koala, while Sikorsky's S-76 fits the requirements of the RFI, as does Bell's 430 utility helicopter. Kamov, whose Ka-25, Ka-28 and Ka-31 helicopters are already in service with the Indian Navy, could enter with either the Ka-126 or Ka-226, since both fit the terms of the RFI.

Additionally, the Navy has committed to purchase of additional HAL Dhruv advanced light helicopters for shore-based operations.

Then the Indian Coast Guard has been long overdue for a major augmentation in rotorcraft operations and is planning to induct 42 helicopters in the near future, comprising with 14 heavy-lift types, 16 medium-lift and 12 HAL Dhruv ALHs.

Angad Singh

Indian Navy Westland Sea King Mk. 42B helicopter.

HAL Dhruv ALH

HAL's Dhruv advanced light helicopter (ALH) is a utility helicopter of the 5-tonne class developed and built in India by Hindustan Aeronatics Limited. The ALH is powered by two HAL-Turbomeca 'Shakti' turboshaft engines producing 1400 horsepower each. The main rotor is a four-blade composite type, and is paired with a conventional X-type tail rotor. The helicopter is designed for India's unique hot-and-high operations and has demonstrated flights up to 8,400m above sea level.

The latest revision of the Dhruv is the Mk. III standard, which incorporates an electronic warfare suite, warning systems, countermeasures dispensers, and an improved vibration control system.

A further development of the Dhruv, with integrated weapons, called the HAL Rudra (or Dhruv Mk. IV WSI – Weapons Systems Integrated) is undergoing testing at present. It aims to incorporate a turret-mounted gun, along with pylon-mounted air-to-air and air-to-ground stores such as missiles and rockets.

Mil Mi-17V5

The Mi-17V5 is a thoroughly modern evolution of the venerable Mi-8 design dating back to the 1960s. Featuring the same Klimov TV3-117VM engines as the Mi-28NE, the Mi-17V5 is being procured in large numbers to bolster the IAF's medium airlift capability. The helicopter is capable of carrying 4 tonnes of cargo internally or 5 tonnes slung externally. Alternatively it can accommodate up to 36 troops for transport or 12 stretchers in the Medevac and Casevac roles. It features a rear loading ramp instead of the clamshell doors featured on older Mi-17 variants, along with a weather radar in a "dolphin-shaped" nose.

In addition to its utility capabilities, the Mi-17V5 also provides 6 external stations for 1,500kg of munitions, ranging from rockets, to missiles to gun pods.

NHIndustries NH90

The NH90 is a medium-sized multi-role helicopter manufactured by NHIndustries, a European partnership consisting of Eurocopter, AgustaWestland and Stork Aerospace. The variant on offer is the naval NH90 NFH (for NATO Frigate Helicopter), geared toward autonomous ASW and ASuW operations, with secondary SAR, CASEVAC, vertical replenishment, anti-air warfare and troop transport roles. The NH90 is able to operate in day or night, adverse weather and during severe ship motion.

It has two engine options: either a pair of GE T700 turboshafts producing 2,115 horsepower each or a pair of Rolls-Royce Turbomeca RTM322 engines with 2,230 horsepower each. The engines power a four-blade composite main rotor, while the fuselage is also largely of composite construction. The cabin can accommodate 14 troops in transport configuration, or 9 stretchers in medical configuration. Additionally, it can carry two standard NATO pallets of cargo internally or 4,000kg slung externally.

The NH90 NFH is equipped with a tactical 360° radar capable of track-while-scan, a sonobuoy launch system, dipping sonar, and can carry a mix of anti-ship missiles and torpedoes in addition to pintle-mounted machineguns for self-defence.

Mi-172 at Tawang.

Pawan Hans – the civilian helicopter behemoth

Pawan Hans Helicopters Limited (PHHL) was incorporated on 15 October 1985 as the Helicopter Corporation of India (HCL), the country's national helicopter company with the objective of providing helicopter support services to the oil sector for its off-shore exploration operations, services in remote areas and charter services for promotion of tourism.

PHHL is a public sector undertaking (PSU) jointly owned by the Government of India and ONGC (Oil and Natural Gas Corporation). Other than providing helicopter services to ONGC for its off-shore locations, Pawan Hans also provides services to various state governments in India, particularly at inaccessible regions such as in the north-east. The organisation also undertakes casualty evacuation and rescue work, provides charter services and manages VIP transportation.

It operates a varied fleet of rotorcraft, including 18 Eurocopter SA 365N Dauphin, 17 AS365N3 Dauphin, 2 Eurocopter AS350B3 Ecureuil, 3 Bell 206 L4, 4 Bell 407, and a single Mil Mi-172 (a civil variant of the Mi-8 helicopter). As part of the previous Plan, Pawan Hans was allocated Rs. 603.5 crores, of which a majority was earmarked for acquisitions. During the Plan, Pawan Hans procured 12 helicopters, from single-engine light rotorcraft to heavier types such as the Mil Mi-172.

Future requirements could increase the Pawan Hans helicopter inventory many multiple times with plans to position PHL helicopters across the country in support of district level administration as also for medevac purposes.

Pawan Hans Dauphin heads out to sea.

THE KEY DRIVERS

Eurocopter AS 550C3 is on offer to the Indian Armed Forces : "a long awaited decision".

Helicopters: outlook and forecasts

In its 14th *Turbine-Powered Civilian Helicopter Purchase Outlook* report, Honeywell expects global deliveries of new civilian-use helicopters will increase to 4,700 – 5,200 over the five-year period 2012–2016. The forecast shows that slower near-term economic growth prospects in key markets have added uncertainty to operator purchase plans this year, however, recent order momentum and strong purchase plans for 2012 bolster the near term outlook.

Recent order rates have been healthy and near term purchase plans remain strong despite lingering tight credit

Sikorsky's X-2 Technology Demonstrator

Sikorsky/UTC

Korea to purchase MH-60R Seahawk multi-mission helicopters

The Defence Security Cooperation Agency has notified the US Congress of a possible Foreign Military Sale to the Government of the Republic of Korea for eight MH-60R Seahawk multi-mission helicopters, associated parts, equipment, training and logistical support for an estimated cost of $1.0 billion. The Republic of Korea has requested a possible sale of eight MH-60R Seahawk's, 18 T-700 GE 401C Engines (16 installed and 2 spares), communication equipment, electronic warfare systems, support equipment, spare engine containers, spare and repair parts, tools and test equipment, technical data and publications, personnel training and training equipment, U.S. government and contractor engineering, technical, and logistics support services, and other related elements of logistics and programme support.

Bell Helicopter receives new army OH-58D contract

Bell Helicopter has announced that as part of the OH-58D Wartime Replacement Aircraft Cabin programme, it has received a contract for the non-recurring engineering and a "new metal" OH-58D cabin. This contract is the latest in a series that have continually added additional Kiowa Warrior helicopters to address attrition rates with the extensively utilised United States Army Kiowa Warrior fleet. This contract addresses airframe age, attrition, and refreshes the engineering and manufacturing planning for the OH-58D air vehicle. Previously, Bell Helicopter was taking older A-model cabins and remanufacturing them into D-model cabins. This contract now addresses airframe age providing a completely new metal cabin

conditions and significant inventories of used current production models for sale which continue to overhang the industry. Concerns over slow economic growth in Western economies has increased the level of uncertainty in purchase plans past 2012 leading to a six point reduction in global purchase plans compared to last year. Based on the timing of purchase plans in the operator survey, and the delivery momentum expected this year and next, the outlook still expects overall industry growth for the five year period 2012–2016 compared to the previous five year period. Over the longer term the China market could be a strong contributor to broader demand for rotorcraft as the country opens its airspace to civil helicopter operation and begins production of indigenously-designed civil turbine-powered rotorcraft.

Global five-year fleet replacement and expansion plans decreased to 19 percent in 2012, down six points from 2011. Although total five year buying plans are lower, specific purchase plans for 2012 remain very strong. Relatively lower levels of planned purchases were concentrated in 2013 and beyond, leading to the expectation that these plans could strengthen materially over the next few years should political and general economic conditions improve as projected. Higher purchase plans in Asia helped offset some of the softness in other region's survey expectations. Purchase plans in major U.S and European centres of demand declined by five and eight points, respectively. Other regions also declined moderately compared to 2011 though their purchase plans remain above the world average rate. Specific purchase plans just for 2012 remain strong at similar levels seen in the 2011 survey. Expectations for new aircraft ordering in 2012 is up over 30 percent compared to 2011 levels, suggesting the recovery will maintain momentum this year.

Global five-year demand for new turbine-powered helicopters is split almost 50-50 between the America's and the rest of the world. Latin America and Asia have the highest fleet replacement and expansion expectations of all regions. (*see 'India's 1000+ Helicopter Plan*) In terms of projected regional demand for new helicopters, Latin America and Asia tied for the world's third largest regional market, following North America and Europe.

Operators who indicated their intent to replace a currently owned helicopter with a new one within the next five years cited "age of current aircraft" or "normal planned or contracted replacement cycle" as key drivers for their decision. This rationale is commonly seen in every survey. Other most frequently mentioned reasons for purchasing a new helicopter in the 2012 survey included lower maintenance costs, warranty coverage, parts availability, and improved reliability/durability. The stronger emphasis on maintenance, operating costs and warranty coverage is a departure from recent surveys which focused more on performance improvements in speed, payload, range and newer technology avionics systems, and likely reflects the slow economic environment faced by many operators.

Light single-engine helicopters continue to be the most popular product class for five-year fleet replacement and expansion. Forty-five percent of all

Russian Helicopters signs with Turbomeca

Russian Helicopters (part of Russian state defence holding Oboronprom) and Turbomeca (Safran Group) have signed a general agreement on support cooperation of Turbomeca helicopter engines in Russia. Such an agreement plans for Helicopter Service Company, part of Russian Helicopters group, to provide engine support services in Russia for the engines manufactured by Turbomeca and used in Russian Helicopters' new light-class Ka-226T and medium twin Ka-62 models operated by Russian military and governmental customers. Ural Works of Civil Aviation, part of Helicopter Service Company, will repair Turbomeca engines in Russia for military and governmental customers under the specific licence agreement.

make/model mentions were for single-engine models in the 2012 survey, down slightly from the five-year average of 49 percent but in line with 2011 findings. The most frequently mentioned light-single models were AS350B series, Bell 407 and Robinson R66. Light-single helicopters had the highest concentration of regional purchase interest in the Americas, while purchase interest was lower in Europe, Asia, the Middle East and Africa.

Intermediate/Medium twin-engine helicopters were the second most popular product class mentioned for purchase during the next five years. Approximately 31 percent of total survey mentions were for medium twins. The most frequently mentioned models were the AW139, Bell 412 EC145 and Sikorsky S76 series helicopters. The highest concentration of demand for medium twins were measured in the Middle East / Africa, Asia and Latin America. Between 40 percent and 50 percent of all make / model mentions in Asia and Middle East / Africa were for medium twins.

The third most frequently mentioned product class was light twins at 21 percent of all make/model expectations.

The AgustaWestland AW101

The EC135, Bell 429 and A109 series helicopters were most frequently mentioned for five-year purchase in this class. Light twins appear to be most popular in Europe and to a lesser extent in the Americas. In Europe, light twin models accounted for 38 percent of total mentions.

Bell Helicopter successes in Europe

Bell Helicopter have completed deliveries of six of its newest aircraft to Europe in one month. Three Bell 407GX aircraft, the first of its kind in Europe, flew to Belgium, Denmark and, most recently, Iceland. Bell also delivered three additional Bell 429 aircraft in Russia and Ukraine.

Bell 407GX

"We are excited about the tremendous customer response to the new generation of Bell aircraft. The Bell 407GX is attracting interest from corporate, private and utility operators due to its speed, range and state-of-the-art Garmin G1000H flight deck that maximises pilot situational awareness. In short, the Bell 407GX delivers exceptional performance and improved safety characteristics," said Danny Maldonado Bell's executive vice president of Commercial Sales and Marketing.

Maldonado added, "Versatility is the name of the game when it comes to the Bell 429, which serves the full spectrum of segments : air medical, law enforcement, oil and gas, utility and corporate. Customers appreciate the 429's spacious cabin, plus Transport Canada's certification increasing the 429 gross weight up to 7,500 lbs. provides a performance boost that doubles the 429's footprint and greatly increases its endurance and loiter times."

Eurocopter's X3 on a US tour

Eurocopter began the US tour of its X3 high-speed hybrid helicopter in July which demonstrated the "unique operational capabilities of this advanced transportation system" during a month of visits to military facilities and hub locations for civil helicopter operators. The tour was initiated with a debut X3 flight presentation at the Grand Prairie, Texas headquarters of Eurocopter's U.S. subsidiary – American Eurocopter – which was attended by employees, elected officials, customers and industry partners. In addition to providing the first-ever demonstration of Eurocopter's innovation with the X3 outside Europe, the company's tradition of "rotary-wing excellence" was underscored by a Grand Prairie Airport fly-in of its product range, from the Alouette III and BO105 to today's UH-72A Lakota for the US Army, the US Coast Guard's MH-65C Dolphin, as well as the EC225, AS350 and EC145 – which are used in civilian operations, law enforcement, medical airlift and parapublic missions.

Eurocopter's aircraft configuration for the X3 uses a pair of turboshaft engines to power a fiveblade main rotor system, along with two propellers installed on short-span fixed wings. This concept is well adapted to missions requiring long transit flights where speed is important, while retaining vertical lift and hover capabilities, all at "very affordable cost." The company envisions a wide range of purposes for its hybrid technology in future products, including long-distance search and rescue (SAR), Coast Guard missions, border patrol missions, passenger transport and off-shore airlift, along with inter-city shuttle services. It also is well-suited for military missions in special forces operations, troop transport, combat SAR and medical evacuation, benefitting from the combination of higher cruise speeds with "excellent vertical takeoff/ landing performance."

In the 2012 operator survey, Heavy Multi-Engine helicopters enjoyed a noticeable increase in interest. This class of helicopters typically garners a small share of overall purchase plans due to the cost and specialised nature of the aircraft. The year 2012 is no exception as purchase plans rose more than a full point and overall share of projected demand increased to nearly three percent. Within the heavy helicopter class ,the most frequently mentioned models were the EC225, the Mi-171 and the S-92. Various Russian models accounted for nearly four percent of the purchase plans in this class.

Plans for increased helicopter fleet utilisation in 2012 were reported by operators in all but one region. Planned increases in each region were:

- ★ North America: 14% of operators planning increases, and only 4% planning decreases
- ★ Europe: 18% of operators planning increases, and 12% planning decreases
- ★ Latin America: 32% of operators planning increases and only 2% planning decreases
- ★ Middle East / Africa: 26% of operators planning increases and only 4% planning decreases
- ★ Asia: 19 % of operators planning increases, and 9 percent planning decreases

Eurocopter

The Boeing CH-47F Chinook heavy lift helicopter is currently being considered for procurement by India

20 EC155 B1s delivered to the German Federal Police

The German Federal Police has formally accepted its remaining two EC155 B1 helicopters from Eurocopter to complete an extensive fleet upgrade programme involving 20 of these multi-role, twin-engine rotary-wing aircraft. A ceremony at Blumberg, Brandenburg marked the service entry of the 19th

and 20th EC155 B1s, joining others that are deployed at German Federal Police bases throughout the country for a wide range of duties – including border patrol, transportation of personnel and special forces, along with diverse search-and-rescue missions. With the two latest aircraft, the German Federal Police now operates a total inventory of 87 helicopters, all of which were supplied by Eurocopter.

The Latin American region reported the highest average utilisation last year (in 2011). In a reversal of 2010 activity levels, Middle East/African operators reported the lowest average utilisation last year, likely affected by the ongoing political instability in the region. When examining utilisation trends across usage segments, oil and gas had the highest at an average of approximately 600 hours per aircraft followed by Emergency Medical Services at approximately 445 hours and several other end use sectors at around 400 hours. The lowest average utilisation was reported by corporate segment operators at less than 300 hours per helicopter.

In a study, *The Market for Medium/Heavy Military Rotorcraft,*" Forecast International projects that that 4,384 of these rotorcraft will be produced during the 10-year period from 2012 through 2021. The value of this production, as calculated in constant FY12 U.S. dollars, is $104.1 billion. The study defines a medium/heavy rotorcraft as one having a gross weight of at least 6,804 kilogrammes (15,000 pounds).

According to this study, the medium/heavy military rotorcraft market is on the verge of a production down cycle that will last several years. *Forecast International* projects that annual production of medium/heavy military rotorcraft will decline from

New from Eurocopter : the EC 175.

Bell Helicopter 429

512 units in 2012 to 399 units in 2017. In 2018, production is anticipated to rise slightly, to 402 units, before resuming a decline the following year. Production in 2021, the final year of the forecast period, is expected to total 376 units.

This expected downturn in the market follows a period of strong market growth that has been fueled by high levels of rotorcraft acquisition by the US military and others. However, defence spending in many nations is increasingly under pressure, and very few major new military helicopter procurement programmes have materialised to keep production rates at manufacturers rising or even stable. At the same time, many key ongoing acquisition programmes are already several years into their production runs, and will soon run their course. Others have been stretched out, with annual production lots reduced in size.

Plans for new-start acquisition programmes are in particular jeopardy. In the U.S., the Air Force's Common Vertical Lift Support Platform (CVLSP) programme has already been terminated. The Navy's VXX presidential transport helicopter could soon follow, or at least be significantly delayed. For now, the Air Force's Combat Rescue Helicopter (CRH) project looks like it will proceed, but this could change.

The longer term Joint Multi-Role (JMR) programme, if allowed to proceed, is an important effort for the US military and the rotorcraft industry. This project is aimed at developing a new rotorcraft

2nd AW169 performs maiden flight

The second prototype of the AgustaWestland AW169, a new generation 4.5 tonne light intermediate helicopter has successfully completed its maiden flight at Cascina Costa in Italy. The first two prototypes will be joined by another later this year and a fourth prototype in 2013. The AW169 programme is on schedule to achieve civil certification in 2014.

The AW169 is part of AgustaWestland's family of new generation helicopters that includes the AW139 and AW189 models. New generation technologies are incorporated in the rotor system, engines, avionics, transmission and electric power generation and distribution systems. The AW169 is powered by two 1,000 shp class PW210A turboshaft engines which will give the aircraft Vertical Cat A / Class 1 capability up to ISA+20 at sea level and maximum gross weight. Latest technologies include an APU mode capability and touch screen cockpit devices.

Russian Air Force Mil Mi-28N : also in competition in India.

AgustaWestland completes armed aerial scout demonstrations

AgustaWestland North America has completed a week of flight demonstrations for the US Army as it moves forward with its Armed Aerial Scout programme. The company performed the Armed Aerial Scout demonstrations with the AW139M as a technology demonstrator and plans to propose a military variant of the AW169 for the mission, based on the US Army's request for information. The AW139 and AW169 possess the same flight characteristics, power-to-weight ratios, safety features and share the same common design philosophy and maintenance concepts.

"We welcome the opportunity to have been chosen for the first Armed Aerial Scout flight demonstrations – we were prepared, ready and we're moving forward," said R. Scott Rettig, CEO of AgustaWestland North America. "We are confident that the breadth and depth of our product portfolio and military expertise will meet the US Army's mission needs, as they assess new technologies and further define the requirements for the Armed Aerial Scout mission."

Russian Helicopters and AgustaWestland to develop new helicopter

Russian Helicopters (an Oboronprom company) and AgustaWestland have signed a Preliminary Agreement to jointly develop, produce and market an all-new 2.5 tonne class single-engine helicopter. The agreement was signed by Bruno Spagnolini, CEO of AgustaWestland and Russian Helicopters CEO Dmitry Petrov. The overall programme will be shared on a 50/50 basis, with the new helicopter being designed for the worldwide market and a wide range of applications. AgustaWestland and Russian Helicopters established the joint venture company HeliVert in 2010 to assemble AW139 helicopters at a new plant in Tomilino, near Moscow. The plant will meet the growing demand for the AW139 helicopter in both Russian and CIS civil markets with production starting this year.

AgustaWestland

Boeing receives first of 10 new fuselages for AH-64D Apache Block III

AH-64D Apache

Boeing has received the first 10 new fuselages designed specifically for the AH-64D Apache Block III attack helicopter from long-time supplier Korea Aerospace Industries (KAI). This milestone paves the way for delivery of the first Apache Block III aircraft with new fuselages next year. The new fuselage incorporates a variety of small but important modifications to accommodate Block III configuration changes, such as enhancements to the extended forward avionics bays and slots for new electronics. Boeing will produce approximately 50 AH-64D Apache Block III helicopters for the US Army under Low Rate Initial Production. The US Army's acquisition objective stands at 690 Apache Block III aircraft. In addition, a growing number of defence forces worldwide (including India) have contracted for or are considering upgrading to or adding the Apache Block III to their rotorcraft fleets.

Sikorsky S-92 "Legacy of Heroes" visits Mumbai

Sikorsky Aircraft's S-92 'Legacy of Heroes' demonstration helicopter visited Mumbai mid-April, hosting customers and recognising local heroes. The *Legacy of Heroes* tour has been logging an exciting journey

for Sikorsky. Visitors to the Sikorsky S-92 'Legacy One' helicopter have had a chance to experience it, step inside, interact with the pilots and crew, and sign a portion of the aircraft, thus becoming part of an interactive "postcard" to the world. The tour had been on an extended visit to India which started on 26 March from Chennai.

"Sikorsky helicopters have been operating in India for some time; in fact, the first helicopter inducted into the Indian Air Force in 1954 was a Sikorsky. When search-and-rescue crews across the world need the ultimate in flexibility and performance, they turn to the Sikorsky S-92 helicopter, and when Sikorsky needed the best facility to build cabins for the S-92, we turned to India," said Air Vice Marshal (Retd) Arvind Walia, Executive Vice President, India & South Asia, Sikorsky.

Elisra's 'ALL-in-SMALL' self protection suite for helicopters

Elisra has unveiled its ALL-in-SMALL unified self protection system, offering a complete, lightweight and compact electronic warfare (EW) suite in a single LRU for any airborne platform. ALL-in-SMALL, a cutting-edge, integrated EW suite, offers for the first time the most advanced multi-spectral DAS and ESM capabilities combined in a single LRU, delivering superior accuracy identification and location. Extremely compact in size and lightweight, the system's modular design and open architecture offer multiple interface possibilities. The ALL-in-SMALL is comprised of an EW controller, digital radar warning receiver, IR missile warning system, advanced laser warning system and chaff/flare dispensing system. It can be optimally integrated with a DIRCM system, due to its high range detection capabilities, high DF accuracy and extremely fast hand-over from IR MWS to DIRCM.

SELEX Galileo protection on-board the UK Lynx Wildcat

SELEX Galileo has welcomed the delivery of the first AgustaWestland AW159 Lynx Wildcat helicopter to the UK Ministry of Defence (MoD) in a ceremony that took place at the recently concluded Farnborough Air Show, the company's contribution being the Active Electronically Scanned Array (AESA) Seaspray 7000 radar. The Wildcat helicopter will be the first UK aircraft flying with the Company's AESA surveillance radar, developed and manufactured at SELEX Galileo's Edinburgh site.

The Wildcat fleet will also be protected by SELEX Galileo's electronic warfare suite, part of the combat-proven HIDAS family.

IAI Lahav upgrade activities

IAI's Lahav division focuses primarily on avionics and weapon systems integration in fighter aircraft, combat helicopters and trainers as well as interface design and supply/maintenance operations.

On the rotorcraft front, Lahav offers maintenance, overhaul, refurbishment, retrofit, upgrade and modernisation programmes. In addition to overhaul and upgrade activities, IAI Lahav has also successfully implemented helicopter programmes together with Russian Design Authorities.

One of the company's more successful helicopter programmes is the Mi-17 upgrade with modernised avionics, greater survivability and improved combat capability. Lahav upgraded the cockpit displays and avionics subsystems as well as added night vision goggles compatibility to the cockpit, while sister divisions Tamam and Elta provided targeting and observation payloads, 'smart' helmets, self-defence suite and EW package.

The tactical upgrade package for the Mi-17 provides the helicopter with full capabilities at night and in adverse weather, which can be adjusted to specific customer requirements to meet cost and operational constraints.

Lahav has also had a significant role to play in India's own domestic helicopter growth with a close involvement in the HAL Dhruv programme. Lahav was selected by HAL to deliver an advanced avionics package for the Dhruv and to optimise its operational capabilities.

Towards this, Lahav actively involved Israeli Air Force pilots and developed a system that could be adapted to meet the needs of any future Dhruv customers.

Bell 525 Relentless gains momentum

Bell Helicopter has announced the latest list of key suppliers for the Bell 525 Relentless, the world's first "super-medium" helicopter. "This is an important milestone for the 525 Relentless programme as we transition from the preliminary design phase into detailed design," said Larry Thimmesch, Bell Helicopter's vice president of Commercial Programmes. "Collaborating with these critical suppliers on our customer solution is testament to just how far the Relentless programme has come in a few short months since it was unveiled at HeliExpo in Dallas, Texas this February".

"The Bell 525 Relentless defines the new 'super medium' product class - positioned at the upper end of the medium class and designed to offer best-in-class capabilities to our customers. It features superior payload and range, cabin and cargo volumes and crew visibility. The Relentless will be powered by the GE CT7-2F1.

family to meet future U.S. attack, scout, and utility rotorcraft needs. *Forecast International* senior aerospace analyst Raymond Jaworowski stated, "The JMR programme promises to develop the US military's first all-new medium/heavy rotorcraft since the V-22." Programme plans call for the initial JMR-based rotorcraft to enter service in the 2025-2030 timeframe.

The *Forecast International* study also includes projections of manufacturer market shares for the 10-year forecast period. The study indicates that Sikorsky will lead the market in both unit production and production value during the 2012-2021 timeframe. Sikorsky has a solid business foundation based primarily, though not exclusively, on US Army procurement of its UH-60 Black Hawk helicopter. AgustaWestland, Boeing, Eurocopter, and Russian Helicopters are among the other key players in the medium/heavy military rotorcraft market.

VSC

Linking Up in Linköping

Aerospace Forum Sweden 2012

Saab AB celebrates its 75th anniversary this year, and what better way to commemorate this landmark than with a four-day event at the firm's home in Linköping, in south-central Sweden? Vayu was there!

Aerospace Forum Sweden 2012 was intended to celebrate Saab's history and to have a vision of the future of military aviation, the theme for the event being 'Technologies and Doctrines.' Over two days, various speakers from across the globe, representing military, scientific and industrial disciplines, presented a wide range of views and analyses to attending media, industry representatives and military personnel.

The two-day conference culminated in a weekend airshow, one of the largest in Europe and notable for featuring a historic 6-aircraft flight comprising Saab jet fighters from the J 29 to the JAS 39.

The conference was inaugurated with a welcome address by Major General Micael Bydén, chief of the Swedish Air Force, following whom was Dr VK Saraswat, Scientific Advisor to the Indian Defence Minister and Director General DRDO, who extended an invitation to "collaborate and partner with India's aerospace programmes."

His presentation entitled *Vision for India's Future Aerospace and Defence* shared a comprehensive view of India's plans over the next two decades in the aerospace domain, including plans for missiles, UAVs and combat aircraft. He pointed out that while India has made "significant progress" in various programmes, it has set itself an ambitious programme over the next two decades for both manufacturing and developing advanced systems including UAVs and AEW&C aircraft.

Dr Saraswat stressed that these goals will be achieved "only through sharing and collaboration." He highlighted the need for sharing of knowledge and collaboration across design and development, going on to state that "IT-enabled development of resources to provide the skill base is our vision. I invite all of you to participate in India's major aerospace programmes."

While accepting that the Agni V ICBM has the capability to be adapted as an anti-satellite (ASAT) platform, Dr Saraswat stressed that India's policy is not to militarise space, and viewed the ASAT effort as essentially a strategic deterrent, which capability would be held in reserve.

In the panel discussion that followed, Dr Saraswat stressed that there have been

some fundamental changes in India's approach to defence development and production, specifically mentioning the changed focus toward the private sector. While the government, he said, had so far been the principal player in the defence sector, "a level playing field is being created for private sector participation which will bring in collaboration with a larger network."

He also pointed out that the earlier low-end component suppliers from India are today becoming adept systems integrators. He was of the view that the government requirement for offsets will create further opportunities for a major role to be assumed by the private sector in India's future defence plans.

Other highlights from the first day of proceedings were delivered by speakers from the Swedish and Hellenic Air Forces regarding experiences during Operation *Unified Protector* over Libya earlier this year.

Lt. Col. Hans Einerth of the Swedish Air Force spoke on the experience commanding the Swedish detachment sent to Libya to provide ISR (Intelligence, Surveillance and Reconnaissance) support during the operations. Based at Sigonella on the Italian island of Sicily, the Swedish detachment of eight Gripen fighters, eight pilots and 35 ground crew generated over 30 percent of the Allied coalition's ISR imagery during the campaign, flying 574 sorties over Libya and providing 2271 reconnaissance reports to the Combined Air Operations Centre (CAOC) on the Italian mainland.

Imagery from the Gripen's SPK 39 recce pod was downloaded, analysed and distributed within 2 hours after landing. The pod does not have a datalink capability for its 25-megapixel photos as yet, but that capability will happen in the near future. Einerth said that it would be ideal in future to have a broadband datalink sending out data in real-time to the relevant analysts at the CAOC and so further shortening the time between the capture of an image and generation of a reconnaissance report.

The Colonel went on to specifically mention how vital a role the image analysts played as part of the Gripen's success over Libya. Study by a practiced eye of infrared images of Libyan oil storage facilities showed the rise and fall

Gripen NG programme update

During the Aerospace Forum, there was a brief media briefing that served as a programme update and question-answer session on the Gripen NG (or Gripen E/F as it is now being referred to).

Eddy De La Motte, head of Gripen exports at Saab, began the presentation by stating that the world market for combat aircraft had to face new realities – budget constraints, uncertain and evolving threats, and a renewed focus on interoperability with allied forces. Additionally, there is the new mantra of "technology transfer" which is becoming increasingly more important for developing countries that need to accelerate domestic knowhow. The Gripen NG is positioned to fit into this new reality as an advanced (4+ generation) and cost-effective option.

Saab forecasts a market for at least 300 Gripens (C/D as well as E/F) over the next decade and aims to firmly establish the Gripen as the leading single-engined multirole fighter in the world. In addition, Saab is committed to launching the Sea Gripen as a joint developmental project in specific markets that demand such an aircraft.

As part of the global push for Gripen sales, Saab has identified three key types of customers:

★ New NATO member states which will be replacing aging MiG-21 and F-16 fleets. There has already been success in this area with states such as Hungary and the Czech Republic.

★ Non-aligned customers that previously opted to operate the Mirage or Jaguar. While the Indian attempt lost out to the Rafale, Saab saw success in South Africa and remains positive on Brazil.

★ States looking to replace legacy F-16, F-18 and F-5 aircraft. Within this group, Saab has delivered to Thailand and won a contract with Switzerland. Other countries they intend to focus on include Denmark, Greece and the Netherlands.

While the Gripen NG (or E/F) will be produced and marketed alongside the current C/D variants, some of the key improvement areas include payload, thrust, as well as range. For customers that require greater capability than the Gripen C/D, the Gripen NG will provide more weapon stations, a larger internal fuel capacity and higher thrust, while retaining similar flight characteristics to the C/D variants. Furthermore, advances in technology developed for the Gripen NG will be applied to future C/D production as well, ensuring that R&D benefits are shared across both platforms.

The second Gripen NG prototype, a single seat 'E' model is scheduled to fly in the second half of 2013.

of petroleum supplies during the conflict, allowing the coalition to judge the level of activity of Libyan government forces. Lt. Col. Einerth also stressed that despite the availability of multiple sources of ISR data – from satellites through UAVs – fighter aircraft bring many advantages such as speed, self defence capability and flexibility, particularly in a non-permissive environment.

The other report on aerial operations over Libya came from Lt. Col. George Kouskoutis of the Hellenic Air Force, who serves as Tactical Director of No. 380 Squadron, operating the Embraer 145 AEW&C aircraft with Saab Erieye radar.

Based at Souda Bay, Crete from March to October last year, the unit provided an AEW&C aircraft in support of *Operation Unified Protector*. The area of operations was mainly in Joint Operating Area (JOA) East, over the Mediterranean Sea to the east of 3 degrees longitude under the callsign 'Carlsberg', while its equivalent to the west (callsign 'Spitfire') was the responsibility of the much larger E-3 AWACS aircraft flown by NATO, the US, UK and France.

Lt. Col. Kouskoutis admitted that initially "we had some fears about whether we could cooperate with these other units, but after a few sorties realised we could cooperate very well."

The single Erieye flew 175 missions, only suffering nine aborts owing to technical or other reasons. Its main role was to help establish the recognised air and surface picture (RASP) and to control combat aircraft heading for missions over eastern Libya.

Lt. Col. Kouskoutis recounted that a US General in charge of the air operations over Libya commented that his unit had "won the respect of the other players" for its performance in the conflict.

The second day of the conference was once again inaugurated by Maj. Gen. Bydén of the SwAF, before handing the floor to General Sverker Göranson, Supreme Commander, Swedish Armed Forces. After an introduction to the day's proceedings, the first speaker was Lt. Gen. Charles Bouchard, Commander of the NATO military mission in Libya, *Operation Unified Protector*. He held the audience in thrall as he recounted the experiences and lessons learned before and during OUP.

Lessons that Gen. Bouchard applied from Iraq and Afghanistan included simple but key points such as understanding that destroying the country's infrastructure would mean having to rebuild it; that if a 'hearts and minds' campaign was needed, it meant that the operation was failing; and the need to zealously avoid strategic mistakes such as seriously offending religious and cultural sensibilities.

Even armed with these and other learning experiences, operations over Libya were not always conducted smoothly, and there were several issues that the General shared at the forum. One was that some of the command staff deployed on two-week rotations arrived in theatre without adequate training. Secrecy classification was a problem with a coalition of 28 NATO nations plus four partners, including Sweden. Standards such as "NATO Secret" could not be applied owing to national restrictions so the General admitted that he could sometimes get more information on events from the Al-Jazeera website than from his own intelligence assets! He then spoke a little more personally, describing his "worst day" as one when the Gadaffi regime claimed that many civilians had died in a strike that killed Khamis Gadaffi. The government spokesman appeared with photographs of dead children and briefly scored a propaganda victory. Generally, NATO policy was to issue the simple facts as soon as they could be established after a mission.

Stressing 'interoperability'– a word that would be repeated often through the day – as the key to future international missions, Lt. Gen. Bouchard closed his presentation with his three "kindergarten rules" for coalition operations: get along with the others in the schoolyard, share your toys and always take a nap in the afternoon!

Lt. Gen. Bouchard was followed on stage by Brigadier General Jiří Verner of the Czech Air Force, who described that nation's experiences conducting air policing operations in the Baltic region, as well as a broader overview of the country's Air Force.

The backbone of Czech air defence is the fleet of 14 JAS 39 Gripen fighters, backed-up by 24 Czech-built L-159 ALCA advanced light combat aircraft. The Gripens are used exclusively for air defence while the ALCAs are also assigned ground attack, forward air control (FAC) and conversion training.

A highlight of recent Czech air operations was the Baltic Air Policing mission from Šiauliai air base in Lithuania in 2009. In addition to maintaining quick reaction alert at home, the Czech AF supplied four Gripens, supported by 75 personnel. The four-month rotation cost €1.6 million and saw eight real life intercepts of uncommunicative aircraft. Brig. Gen. Verner even displayed a slide of a Russian Air Force Il-38 'May' ELINT aircraft being shadowed by a Gripen.

The Czech Gripens were followed in the Baltic Air Policing mission by a

Looking to the future: Gripen's HUD.

Luftwaffe Typhoon detachment with 200 personnel, and will return in August 2012 for another air policing stint.

Following a 'Silver Tiger' award won at the Czech AF's first *Tiger Meet* exercise in 2009, Brig. Gen. Verner said that he considers his air force has been "fully accepted as a NATO member" and that he would "love to keep that going after 2015" which is when the current lease arrangements for the Gripen are due to end.

Another Gripen-operating arm, the South African Air Force, which was represented at the forum by Lt.

Gen. Carlo Gagiano, outlined their own unique operating paradigm, with tasks ranging from air defence to anti-poaching activities.

The Lt. Gen. recounted a rare NATO-SAAF interaction last year when President Jacob Zuma flew to Libya in an attempt to broker a settlement with the Gaddafi regime. He said of that mssion: "for the first time that I can remember, if ever, that we have sort of touched NATO."

He went on to extol the Gripen's role in the SAAF's air policing mission during the 2010 football world cup, as well as the upcoming integration of the Thales Joint Reconnaissance Pod on the aircraft. With critical budget decisions looming in South Africa – as they are almost all over the world – the General cocluded by saying that while the SAAF had optimised its resources thus far, they were "at the limits" of their financial constraints and that mere optimisation would no longer be enough to deal with the realities of economic issues.

Following a break for lunch, Maj. Gen. Scott Rice of USAFE provided a brief look at the future role of US armed forces in enhancing global and regional security, reaffirming the US commitment to Europe but echoing Lt. Gen. Gagiano's concerns about shrinking military budgets and ever-tightening constraints being placed on military operations.

The finale was provided by Air Commodore Ian Teakle of the RAF, Brigadier General Helmut Schütz of the Luftwaffe, and Brigadier General Jean-Luc Crochard of the Armée de l'Air, who spoke of the global outlooks of their respective air forces and also their regional roles and further aspirations.

A lively panel discussion followed, with aerospace journalists Rob Hewson, Vago Muradian, André Forkert and Bill Sweetman joining the day's speakers on stage to pose questions directly as well as take further queries from the audience.

Major General Micael Bydén then took the stage for the last time to conclude on what had been an enlightening and engaging two days at Linköping and expressed hope that there would be cause to host another Aerospace Forum in two years' time.

The climax of the Forum was, of course, the air show over the weekend, featuring a wide variety of aircraft displays. Unfortunately, the weather on Saturday was somewhat grim, and *Vayu* did not attend the Sunday show owing to the early return flight back to Delhi that day. There was a persistent light drizzle and a bitterly cold wind, but neither did much to dampen the enthusiasm for what promised to be a day for great flying. There were a number of aircraft on static display, ranging from transport, to maritime patrol, and even a C-17 Globemaster III from NATO's SAC (Strategic Airlift Capability) in Pápa, Hungary.

The Swedish Air Force Historic Flight were at the show with their line-up of an Sk60, J32 Lansen, Hawker Hunter, J29 Tunnan, J35 Draken and the recently restored AJ 37 Viggen, proudly on display. The highlight of the day's flying was the 6-aircraft formation of all the jet aircraft Saab has produced from the Tunnan (first flown in 1948) to the Gripen which is under current production and operation.

The Tunnan and Draken also put up short solo displays but a tyre failure after the Tunnan display caused the Lansen and Hunter flights to be cancelled, while a hydraulics issue on the Viggen also kept it on the ground for the remainder of the day.

Also notable were the visiting Swiss Air Force Pilatus PC-7 aerobatic team, the tactical helicopter display, a 9-aircraft Sk 60 aerobatic formation, and of course, the four Gripens in formation.

Photos and text: Angad Singh

The Saab 340 Erieye.

The Historic Flight, with J 29 Tunnan, Sk 60, J 32 Lansen, J 35 Draken, AJS 37 Viggen and JAS 39 Gripen in formation.

Gripen taxiing back to the ramp after the Historic Flight display.

Saab Gripen C of the South African Air Force

Launch of the Saab 340 MSA

Expanding its airborne surveillance family, Saab announced the Saab 340 MSA (Maritime Surveillance Aircraft) product line at Linköping at the sidelines of the Aerospace Forum Sweden 2012.

The 340 MSA will join the Saab 2000 'Swordfish' maritime patrol aircraft, the Saab 2000 'Erieye' AEW&C platform, and the Saab 2000 'Airtracer' ELINT/COMINT aircraft.

Many countries require to enhance their coastal surveillance capabilities, especially owing to increasing number of offences committed at sea in the form of oil spills, human trafficking, illegal fishing and piracy.

Saab have decided to invest in the modification of a retired civil Saab 340 aircraft to the 340 MSA standard as a demonstration aircraft. The 340 MSA offers many advantages and is "highly favourable in terms of cost compared with its competitors." The Saab 340 MSA is a multi-purpose aircraft, offering surveillance, transport and MEDEVAC (Medical Evacuation) capabilities. The cabin is of a high standard, equipped and furnished to provide a comfortable working environment. The technical platform offers a good overview of large coastal expanses, enabling a rapid response.

"Maritime Airborne Surveillance is a fast growing market throughout the world. With the 340 MSA, Saab has a market position where we will be seeing a substantial increase in airborne systems," said Rickard Hjelmberg, Vice President, Maritime Surveillance Area within Support and Services.

Considerable man hours have gone into transforming the Saab 340 into a 340 MSA with radar system and thermal imaging camera. The aircraft was on display for the first time at the Aerospace Forum Sweden in Linköping and will also be displayed at the Farnborough International Air Show followed by African Aerospace & Defence, which is being held in South Africa in September 2012.

The NHI NH90 is known as the HKP 14 in Swedish service.

Pilatus PC-7s of the Swiss Air Force PC-7 Team

Tell-tail!

Angad Singh

'The united colours of Gripen' !

"An exhilarating experience !"

Vayu arrived at Linköping on 31 May, a day before the *Aerospace Forum Sweden* was to begin, and to make most use of the time available, was given an extensive tour of the Saab facility with a close look at the Gripen NG demonstrator aircraft as well. While being shown around the facility, *Vayu* came across Dr. Vijay Kumar Saraswat, on his way to a demonstration flight aboard a two-seat Gripen D.

Dr. Saraswat was all smiles kitted out in his flight suit as we walked down to the ramp and talked briefly about DRDO's relationship with Saab and his upcoming presentation at the Aerospace Forum. Prior to takeoff, he spent a few minutes posing for *Vayu*, even flashing a thumbs-up from the cockpit.

His flight lasted around an hour and Saraswat seemed flush with adrenaline on his return. The scientist was grinning with exhilaration as he described the G-forces during the flight, the thrill of going supersonic and a sharp vertical climb. He said the aircraft seemed to "fly well" and appeared to be "very user-friendly."

The DRDO chief's flight in the Gripen comes, of course, after the MMRCA competition has been decided in favour of the French Dassault Rafale, but obviously has more to do with Saab's own interest in engaging with the DRDO in a variety of programmes, such as the LCA Mk.2, AMCA, unmanned air vehicles (including UCAVs) and others.

The same engine – the GE F404 – powers the Saab Gripen and LCA Mk.1 and Saab has offered DRDO assistance with the airframe and engine on the Tejas Mk.1 and Mk.2 aircraft. DRDO has admitted to problems integrating the F414 into the LCA for the Mk.2 variant and could possibly benefit from Saab's experience with development of the Gripen NG, which employs the same engine.

The Tejas and Beyond

The LCA story is a classic example that could teach us many lessons, provided we are willing to learn. To begin with it is a déjà vu of the Marut HF-24 saga enacted 40 years prior to the LCA and not one lesson has been learnt from those mistakes. But for those willing to embark on a similar project in the future, it holds a wealth of information that could make any project succeed. The major lesson we must learn from the LCA story is how not to do things! This repartee to media and official news reports is not an indictment of ADA and HAL, but only meant to bring initiated well-wishers up to speed, with the present status and highlight the weaknesses, in order to have someone address them. Our awareness and indulgence is mandatory since the huge cost overruns are funded from our money…..the tax payer.

The present CAS' press statements from time to time, are absolutely on target. His predecessor was constrained to accept that the Initial Operational Clearance (IOC) was completed at the end of 2010, because the Defence Minister made an irresponsible and misleading public statement that the IOC had been achieved. The IOC, with concessions, will probably be accorded after satisfactory completion of the flight tests, sometime around the last quarter of 2012. Despite having flown approximately 1,800 sorties, certain segments of avionics integration and envelope clearances remain unexplored and unless addressed by the very competent and professional IAF/IN team of test pilots and flight test engineers at the National Flight Test Centre, it will be left to the poor squadron pilot to deal with surprises. For instance, no tests have been planned for engine restarts of a cold engine in the air. The amount of accessories mounted on the engine gear box are unlikely to permit the minimum wind milling RPM mandatory to restart in the air. ADA must ensure that the auto-relight/manual hot relight systems are absolutely fail-proof.

Another area of huge concern is the absolute disarray of documentation...in the past we blamed the Russians/French/British et al. for not giving us all the information we needed. Whom will we ask now or who will tell us about this aircraft, if we do not produce the documentation, not only for safe operations, but also for posterity? ADA has outsourced this very important aspect to a private firm for a reported sum of Rs 1.5 crores, spread over a 3-year period for producing the pilots' manuals. The sum, to the L1, is grossly inadequate to fund a team of domain experts with the requisite tools and wherewithal to take up this very challenging task. A one-man army, notwithstanding its credentials, cannot achieve this task. Remember, it has never been done before in India. Hence, this venture could have been an ideal opening for a joint venture, where we could have learnt, as well as produced a professional document.

HAL on the other hand has given the task for the technical manuals to the BAe-HAL concern, about seven years ago. What has been produced to date is shrouded in secrecy, but it would be worthwhile for the Maintenance Branch of the IAF to vet these documents, before they are officially handed over. None of these documents necessary for induction of the aircraft into service show any confidence of completion before that event. What is also required is a well-chronicled history of the whole cycle of design and development with the most valuable contribution being made by a faithful account of mistakes and shortcomings that could be used in future. But will we be mature enough to do that? Not likely, unless the powers that be, insist. Past record of professional integrity, does not make one an optimist. However, this must be a historical document and not an expose of the guilty. All professional aviation companies have a Technical Publication Department consisting of representative personnel from each discipline. This is a central repository that not only collects and collates data, but is the single point for setting standards, requirements, data generation and controlling/sharing of information. ADA would be well advised in setting up a similar facility. There are numerous models available to choose from.

There are many more grey areas, but several shortcomings of this aircraft are being swept under the carpet under the guise that they will be addressed in the Tejas Mk II. The latter gives ADA a lien of at least 5 years more. This version is driven by the performance shortfalls of the Tejas Mk I. One cannot help but be sceptical about the success of this variant, since ADA openly declares that the IAF has found a panacea for this by recommending a more powerful power plant, the GE F414. This is a more powerful engine, but it also weighs more and is larger in dimension, demanding many structural changes and redesigns, including that of the intakes. So how much gain, if any, will there be? ADA has yet to determine the exact figures to quantify the gain, after the weight and drag index increase. If this fails to obtain the desired results, will the IAF be held accountable for suggesting this solution... has ADA no onus/contribution to address these issues themselves?

Three decades down the line, the Tejas programme is still floundering due to quality control and slow production of aircraft, amongst several unresolved issues. Twelve aircraft have been produced, including the first prototype, which flew in January 2001. Flight testing is inching forward at a snail's pace because of these factors. A strong impetus needs to be given to this programme to have HAL produce more aircraft in the time span allocated. Lack of accountability and inability to professionally manage a project of this magnitude are the two key contributors to the slack progress and untenable standard of this aircraft. Good designers and good engineers do not necessarily make good leaders. A leader can be a manager, but a manager cannot be a leader. This makes a convincing case for the IAF to be handed over the reins and the onus of running a programme for an aircraft that they will operate in peace and war.

A successful precedent already exists in India. The Indian Navy runs all the public sector shipyards in India with a full complement of civil designers and engineers, aided by naval officers. Each one is a success story, contributing handsomely to the national goal of achieving self-sufficiency in defence production. The IAF should promote this more actively, than in the past. The government needs to be shaken out of its moribund stupor on this issue.

ADA was created for the specific purpose of designing and developing the Tejas. The onus of designing the Tejas Mk II and the Vth generation fighter has also been given to ADA. Whilst the Tejas Mk II will emerge from its predecessor, the Vth generation aircraft is not necessarily a logical follow on. Since national resources are not limitless, it is better to strengthen existing institutions, rather than divide these scarce resources between several agencies....however this statement loses its validity if there is no accountability within these institutions. The Tejas, whenever ready, can at best be categorised as a Gen III+ aircraft. The MMRCA is Gen IV, so it would be a bit unfair to expect ADA to leapfrog straight into designing a GenV aircraft, despite any pretentions to do so.

World-wide, consortiums/JVs/ partnerships are being forged to explore, develop and design technology. This not only allows knowledge sharing, but defrays the exorbitant investment involved. Cutting edge technologies are available with some advanced nations, who are looking for markets. India is a panacea for their search. Once we have caught up with the technologically advanced nations, through synergising our strengths with theirs, then only a 'do it yourself mantra' could be encouraged. One has to be both naïve and gullible to believe that the Fifth Gen T-50 with Russia is a joint venture. The aircraft had already completed its maiden flight before we signed the MOU. So what is our contribution to this 'joint venture', other than funding it? Such an important project should have had us totally involved from the design and development phase to the final stage of inducting it into service as a weapon system. Do we now know how to design a Fifth Gen aircraft, because of our participation in this JV? Has the aircraft been designed to fit our requirements or will our requirements be tailored to fit the aircraft? There does not seem to be much value for the Indian design and development engineers, who would not have participated in the basics of designing a Gen IV or Gen V aircraft. It also seems unclear at this point in time whether the IAF has determined what it wants in a Gen V aircraft or will the Russian Gen V decide what the IAF requires! An Indian Gen V aircraft is imperative to the growth and advancement of the aviation industry…. but let's not blow it this time, folks.

Joint ventures have been given much publicity by the government and the benefit that accrues from obtaining state-of-the–art technology cannot be denied. For the private sector, hitherto kept out of defence technology, this is the only way to become a player to reckon with. The DPSUs also need these advanced technologies, but many try to go alone by starting at the nadir to reinvent the wheel. Since no accountability exists in these units, parochial ego issues often over-ride business sense. Despite this there are some joint ventures, but none of any significance. While small parts, avionics, and other items that go into the completion of a weapon system are finding a place in joint ventures, but the ultimate test of making our own aircraft is yet to be accomplished. The government needs to take a call on whether they wish to pander to the egos of a certain strata of the public sector or promote know-how and efficiency in the aviation sector, where our industry sadly lacks international and domestic credibility. We, the taxpayers, need to have a say in this.

Air Cdre (R) Parvez Khokhar

Former CNS Admiral Arun Prakash writes on

The LCA-NAVY

In this artist's depiction (taken from an ADA brochure), the LCA Navy is launched from a stationary aircraft carrier, its landing gear already retracted.

IS IT READY FOR SEA?

The long-awaited maiden flight of the LCA-Navy prototype (NP-1) took place on 27 April 2012, from HAL Airport Bangalore (*see Vayu III/2012*). NP-1, with the Chief Test Pilot of the National Flight Test Centre, Navy Commodore J A Maolankar at the controls, undertook a successful 20 minutes flight. This significant event seems to have evoked mixed reactions in different quarters. Some media, sceptical as ever, had posed many unanswered questions: was there a problem with the airworthiness certificate? Why was the undercarriage left down for the flight, and where is the tail-hook? The Indian Navy (IN) is relieved that the prototype, which was rolled out in mid-2010, is at last airborne, but surely wants to know too when it will be ready for shipboard deployment.

As a chair-borne commentator, I venture to offer a few words of reassurance to those who ask. No prototype aircraft can get airborne for a flight without a specific clearance from the Centre for Military Airworthiness and Certification (CEMILAC) and two years is not an excessive duration for ground testing of the airframe, engine and numerous systems of a prototype, much of it undertaken to satisfy stringent CEMILAC criteria. The first flight of any prototype is kept as short and simple as possible, because the main objective is to prove that its major systems and components, especially the computer-generated digital flight control laws, are functioning effectively and harmoniously. The undercarriage is left down for the first few flights, as a precautionary measure against stability problems or system failures; in this case it also happens to be of a new design. The tail hook, presumably, has no useful function to perform at this, early, stage of flight-testing and will possibly be attached later on.

The answer to the Navy's question, however, is not so simple and I intend to devote the rest of this article to it. But first let us place the ambitious LCA-Navy project in perspective, by discussing the rationale behind the IN's quest for a machine such as this.

Landing gear not retracted, NP-1 takes off on maiden flight.

Photo: Sanjay Simha

Equipping the Indian FAA

India's Fleet Air Arm has a history of nurturing its machines with care. The 78 first-generation Sea Hawks acquired, second hand, from the UK, Holland and Germany, were flogged for nearly two decades till there were no spares to be had from anywhere. Of the 28 Sea Harrier V/STOL fighters acquired 30 years ago, a dozen are still in front-line service. In fact, after their mid-life upgrade with Israeli radar, BVR missiles and data-link, Sea Harrier pilots claim to hold their own against 'attacking' IAF Su-30s. The revolutionary 'jump-jets' will be replaced by 46 fourth-generation MiG-29K (K stands for *Korabelnyy*, or shipborne) fighters, the first 16 of which have already been delivered. These aircraft are uniquely configured to operate from an aircraft carrier in the 'short take-off but arrested recovery' or STOBAR mode.

The former Russian 'heavy aircraft carrying cruiser' *Admiral Gorshkov* is reported to have sailed from the Sevmash shipyard, on 8 June, on completion of a (badly bungled) 8-year long refit, for comprehensive trials of the ship's machinery and systems. Two company-owned MiG-29Ks flown by Russian test pilots will undertake aviation trials to check the 14-degree ski-jump, the arrester wires, the radio and optical landing-aids and ship-aircraft data link. On completion of the lengthy trials schedule, she is due to be commissioned as INS *Vikramaditya* on Navy Day 2012. On arrival in India, in early-2013, this carrier, modified for STOBAR operations, will embark her complement of MiG-29Ks.

A second squadron of MiG-29Ks will operate from the new INS *Vikrant,* also being built as a STOBAR ship, in Kochi Shipyard Ltd and due to be commissioned in 2015. As far as the follow-on indigenous aircraft carrier (IAC-2) is concerned, once its design parameters are frozen the ship may take 6-8 years to complete. However, it is early days for the IAC-2 and a chicken-and-egg situation is likely to prevail for some time, as far as ship configuration and aircraft choice are concerned.

From this it appears obvious that the IN has provisioned adequate fighters and trainers to equip two carrier-borne squadrons, plus a training element ashore and then have something left over for attrition. If this be so, where does the LCA-Navy fit in, and what stakes does the IN have in its ultimate success?

To understand why the IN backed the LCA and has, so far, contributed money, manpower and motivation to the project (while other stake-holders have sat on the fence) one needs to delve into history.

Sea Harrier of INAS 300 ('White Tigers') comes in for vertical landing on INS 'Viraat'.

MiG-29 KUB of INAS 303 ('Black Panthers') makes conventional landing at INS 'Hansa'.

The Navy's Stake

The DRDO, while launching the laudably conceived LCA project in 1983, perhaps over-stated its capabilities by claiming that it would develop not just the airframe and avionics, but also the engine and radar as well as digital flight controls for what was only its second venture into fighter development after the HF-24 Marut. Ten years later, the programme was languishing due to lack of IAF few successes had, despite occasional recriminations, strengthened mutual confidence. Most significantly, the early 1990s saw the design of the navy's 20,000 ton carrier (then designated as Air Defence Ship) hanging fire for many years owing to uncertainty about the type of aircraft that it would operate.

The aircraft choices available to India in the early 1990s were severely circumscribed because aircraft of US-origin, by far the most capable in the market, were then just not available to us. The Russians, our main purveyors of military hardware at that time, had only one shipboard fighter, the three-engined VTOL fighter Yak-36 (*Forger*) to offer. The Sea Harrier had, by then, revealed its shortcomings, but it was still superior in most respects to the *Forger*. In the conventional category there was just one aircraft, still under development for the French navy - the Rafale. Reports of Soviet experimentation with shore-based machines for ship-borne operations were still unsubstantiated.

Two years back : First LCA-Navy being 'rolled out' at HAL's AR&DC hangar in Bangalore on 6 July 2010.

Defence Minister AK Antony at the roll out of NP-1, flanked by Admiral Nirmal Verma, CNS, Cmde Balaji, Dr VK Saraswat and Dr Prahalada.

interest as well as of government funding. At this juncture, the navy decided to make preliminary enquiries about the possibility of a ship-borne version of the LCA.

The decision to back this embryo project was rooted in a number of reasons. The success of the first indigenously built frigate, INS *Nilgiri*, in the 1960s had crystallised a resolve in the IN that we would be a 'builders navy' rather than a "buyers navy", and indigenisation became an article of faith within the Service. Secondly, the traditional IN-DRDO partnership having delivered a

For Naval Headquarters (NHQ) a clinching factor emerged clearly from contemporary geo-politics; the steam catapult used to launch aircraft from carriers was manufactured only in the USA. Since this piece of machinery was unlikely to be available to India, we could discard ship designs which were based on aircraft requiring a catapult launch. This eliminated all US-origin deck aircraft as well as the Rafale. By now overtures were emanating from Moscow, offering the derelict *Admiral Gorshkov* as a "gift", with the proviso that a Russian shipyard would re-build it to operate the Su-33 or MiG-29. This sparked off an exciting notion in NHQ; perhaps the ADS could be designed as a STOBAR ship provided the LCA could be modified to operate in this mode ?

Enquiries about the possibility of a ship-borne version of the LCA having received an enthusiastic response from DRDO, a feasibility study was launched in 1995, and the rest is history. With the materialisation of the *Gorshkov* deal the IN would, for the first time, have a modern carrier with state-of-the-art fighters at sea. Although relieved of operational pressures as far as tactical airpower at sea was concerned, the Service has remained steadfast in its commitment to the LCA.

The Navy's stake in the LCA is best summed up in the words of its visionary 'Maritime Strategy:'

"The ongoing aerospace projects are bold and pioneering ventures into many esoteric fields like airframe and engine design, weapon system integration, flight-control development and evolution of new materials. It is inevitable that these projects will face many hurdles, impediments and delays, but the IN will give them full support and backing. While the IN will demand quality from the DRDO, we will also extend financial and manpower support for vital projects."

The navy's leadership has always believed that India's claims to big power status would ring hollow as long as it remained dependent for 70%-80% of major weapon systems on foreign sources. The success of the LCA Navy would not just put India in a select club and provide an invaluable impetus to the aerospace industry, but would also form a launch-pad for further maritime-technology ventures. The Service was well aware that the project would, not surprisingly, have its share of problems.

The Problem Areas

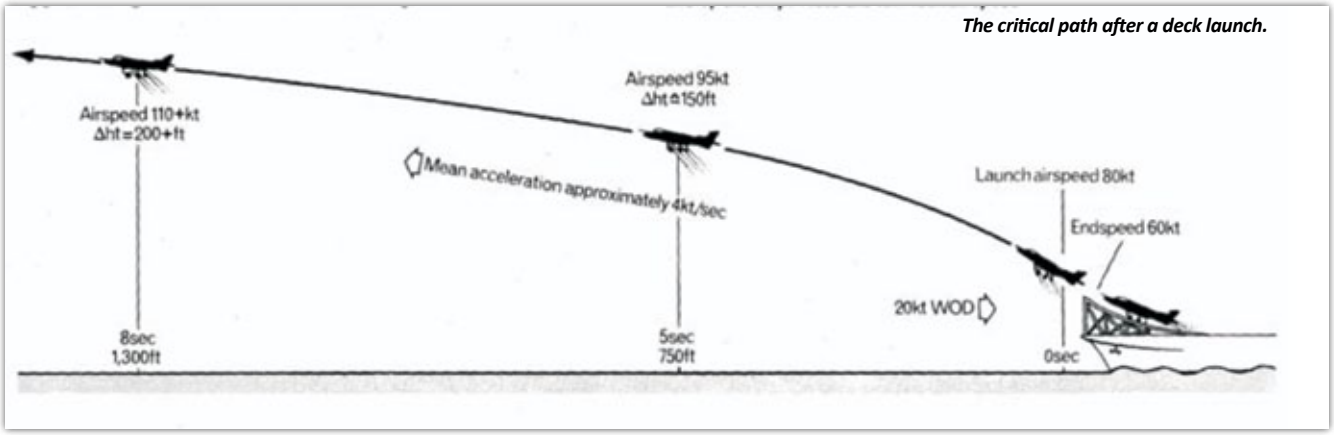
It is common knowledge that fighters such as the F-4 Phantom, A-4 Skyhawk, F-18 Hornet and Rafale M, conceived for carrier operations, have been adapted without any problem for shore-based operations. The reverse, however, is not true and an aircraft designed to land and take-off from a 10,000 foot runway, must undergo major modifications before it can operate from a ship's pitching and rolling 800 foot flight-deck.

Sure enough, the Project Definition study undertaken by the Aeronautical Development Agency (ADA), with help from TsAGI, the Russian Central Aerodynamic Research Institute indicated a number of critical areas which would need to be addressed before the LCA-Navy project could be declared a feasible proposition:

Tailhook of E-2C Hawkeye.

- The rate of descent involved in a (no flare) carrier landing being almost twice that of a flared touch down ashore, would require a much stronger landing gear.
- The designed landing speed of the aircraft was too high for the ship's arrester gear to handle.
- A hydraulically-operated tail-hook would need to be mounted in the belly to engage the ship's arrester wires and bring the aircraft to a stop in about 250 feet. This would require the belly mounting to be strengthened to withstand sudden deceleration forces.
- The relatively low approach speed required for a carrier landing would necessitate this delta-wing to fly at high angles of attack leading to reduced forward visibility. It would be necessary to restore visibility so that the pilot could make an accurate deck landing.
- With the available engine thrust, it was computed that the aircraft would attain a safe height of about 150-200 feet on exit from the ski-jump. The speed of 120-130 knots would, however, be just marginal to retain aerodynamic control while the aircraft accelerated, and there were doubts about controllability during this transition phase. (The Sea Harrier, too, exits the ski-jump at sub-stall speeds but control is retained by use of reaction controls powered by engine exhaust.)

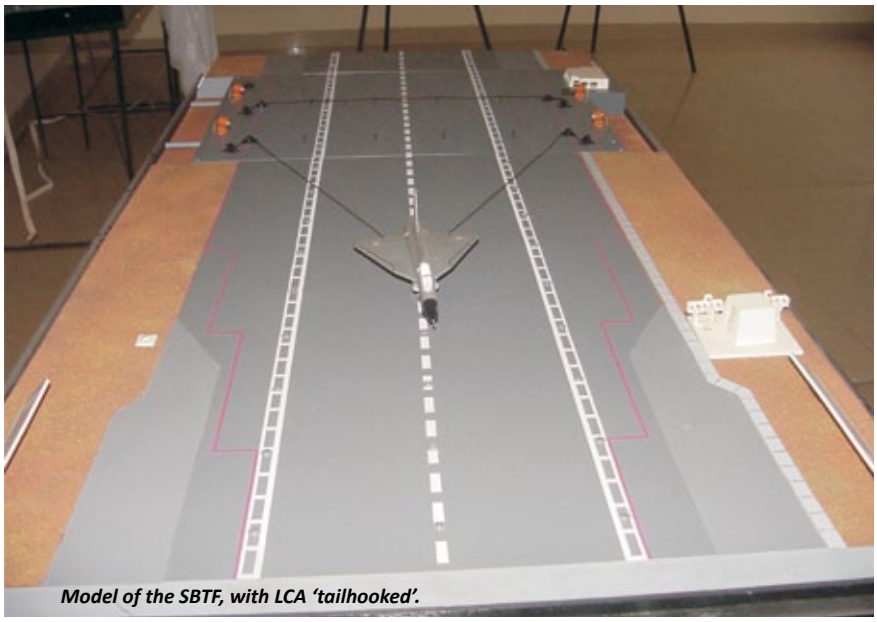
Undaunted by the scale of technological challenges posed by these observations the relatively inexperienced ADA team expressed confidence that it could find ways to deal with each of the hurdles and produce a prototype LCA-Navy. The IN, true to its word, re-affirmed its faith in



The critical path after a deck launch.

ADA and the programme by producing a set of Naval Staff Qualitative Requirements and initiating a jointly-funded engineering development programme in 2003 with a contribution of over Rs. 400 crores. It also

Key technology and design differences between the land-based LCA and LCA-Navy are (above, clockwise) the Levcon (leading edge vortex controller) close to the forward root of the wing in the apex region ; main landing gear able to take high landing sink rate of 7.1 m/s ; arrester hook to engage landing deck wires, with longitudinal deceleration of nearly 4.5 'g'.



Model of the SBTF, with LCA 'tailhooked'.

found scarce aeronautical engineers and test pilots to help manage the project.

Pains of Transformation

Bringing to bear all their ingenuity and initiative, the LCA-Navy team commenced the process of 'navalising' the IAF Tejas for shipborne operations. The first step was a new undercarriage, designed with Russian help, to withstand a vertical rate of descent of 7.5 metres/second, as opposed to 3.1 metres/second for the land-based version. A little-used aerodynamic device, known as leading-edge vortex controller or LEVCON, was incorporated in the wings for improving low speed handling and reducing the landing speed. A tail hook was designed for fitment on a suitably reinforced under-belly fuselage mount. The 'drooped' nose design of the IAF trainer version was adopted for the LCA-Navy to improve over-the-nose visibility on carrier approach. Repeated computer simulations gave the team enhanced confidence that the transient post-ski jump instability could be countered by some extra engine thrust and changes in the fly-by-wire (FBW) software.

Two unforeseen but avoidable factors have impacted adversely on the LCA development and could well jeopardise the programme unless some early and resolute remedial measures are initiated. Firstly, the basic aircraft having overshot its design weight, the addition of a heavier landing gear, a tail-hook and associated reinforcements has aggravated the weight problem considerably in the case of LCA-Navy. Secondly, the indigenous Kaveri engine having failed to meet development milestones, the project has had to fall back on the General Electric F-404-IN-20 afterburning turbofan, and 40 have recently been contracted for the Tejas.

The F-404 is said to barely deliver the thrust necessary to meet IAF performance requirements. The heavier LCA-Navy, during many phases of carrier operations, especially ski-jump launch or a late go-around on approach, will be operating at the limits of its envelope where lack of engine thrust would be a debilitating handicap. Further, the air-intake design of the Tejas is optimised for high mach-numbers and tends to 'starve' the engine of air at low speeds, which could aggravate the thrust-deficiency for a ski-jump launch. Reducing payloads to maintain safety margins will result in performance penalties unacceptable to the Services. Unless the Kaveri project can be salvaged with foreign assistance, a better engine will have to be identified to power the LCA-Navy and the search should have started yesterday !

Challenges Ahead

As the LCA-Navy flight-test team embarks on the unique venture of qualifying an unstable, FBW, delta-wing prototype for STOBAR operations, the road ahead programme promises to be exciting - but complex. The current plans call for a second prototype, a single-seat fighter, to join NP-1 as technology demonstrators for

undertaking ski-jump and deck-landing trials as well as weapons integration and carrier certification.

It appears that the undercarriage, described by the Chief Test Pilot as akin to "a WWF wrestler", as well as the tail-hook, have been over-designed and are excessively bulky. This may be understandable as a measure of caution, but it is also surprising because the Russians, who provided such advice, had recent experience of designing undercarriages and hooks for a number of their own carrier-capable aircraft types. It will, therefore, be necessary on successful completion of trials, to re-design an optimal undercarriage and hook for fitment on subsequent aircraft. With more engine power, weight reduction measures and other improvements, this will become the LCA-Navy Mk II.

Although the availability of test-rigs, telemetry and a simulator in ADA have taken a lot of toil and suspense out of flight-testing, there are many segments of the performance envelope which will require investigation by skilful and resolute test pilots. The trials programme will first be conducted ashore and then on board the *Vikramaditya*. The shore segment will have two parts : launch over a 14 degree ski-jump, and recovery into a set of arrester wires using the tail-hook. The carrier trials will, essentially, be a repeat, except for two additional and crucial variables : deck-motion and relative wind.

The SBTF

The shore-based test facility (SBTF) being created at the Naval Air Station Goa, at considerable expense and effort, is yet one more manifestation of the serious IN-DRDO cooperation and commitment to the LCA-Navy. The Russians, who pioneered the STOBAR concept, successfully undertook the daunting task of converting the shore-based, Su-27K (or Su-33), MiG-29K and Su-25G, into carrier-borne versions. For testing these aircraft, and subsequently for training squadron pilots, they had created an elaborate facility at the Nitka Centre close to the Ukrainian port of Sevastopol.

The Indian SBTF, a replica of 'Nitka', will be equipped with a 14 degree ski-jump located at the end of a taxi-track, on a 150 foot high cliff overlooking the sea. A hydraulic arrester gear, with three wires, will be installed on a small stretch of parallel runway created for this purpose. The Luna optical landing aid, installed on *Vikramaditya*, will also be replicated here.

An F/A-18B Hornet of the US Navy's VX-23 Test and Evaluation Squadron shepherding a freshly-constructed unpainted F-35C, with tailhooks extended on both aircraft.

After NP-1's maiden flight at HAL, Bangalore, Cmde Maolankar seen with Rear Admiral D Sudan, ACNS (Air), PS Subramanyam, DG LCA at ADA and members of the National Flight Testing Centre (NFTC).

The entire facility will be overseen by a flight-test and telemetry centre.

Trials Programme

Although sufficient data is available, from many sources on arrested recovery performance, in the case of LCA-Navy, the design of the tail-hook, its strength and positioning are critical factors which will need to be empirically tested. Starting with taxi engagements at increasing speeds, the trials will progress to actual arrested landings, and culminate at maximum landing weight. It is noteworthy that the F-35C version of the JSF has recently failed the taxi engagement test, because the tail-hook is, apparently, positioned too close to the undercarriage. After the wheels roll over the arrester gear, this particular

geometry does not allow sufficient time for the disturbed wires to settle down as the hook tries to engage them.

The real unexplored territory for the trials team will be the ski-jump launch, which requires investigation of aircraft performance and behaviour in many areas. Some of these are: relationship of all-up weight to deck run, engine thrust and relative wind, undercarriage oleo compression on the ramp and sudden extension on exit, controllability at ski-jump exit and acceleration thereafter. A crucial factor in this phase will be accurate estimation of engine thrust available under given ambient conditions of temperature and pressure. The test team is hopeful that it will be possible to indicate the maximum thrust available from the aircraft power-plant as a number on the cockpit head-up display.

components during shipboard operations in rough seas. Accurate recording of parameters and sensible stipulation of operating limits is called for otherwise as Cmde Maolankar puts it, "You will have either an over-designed aircraft or a broken (under-designed) one."

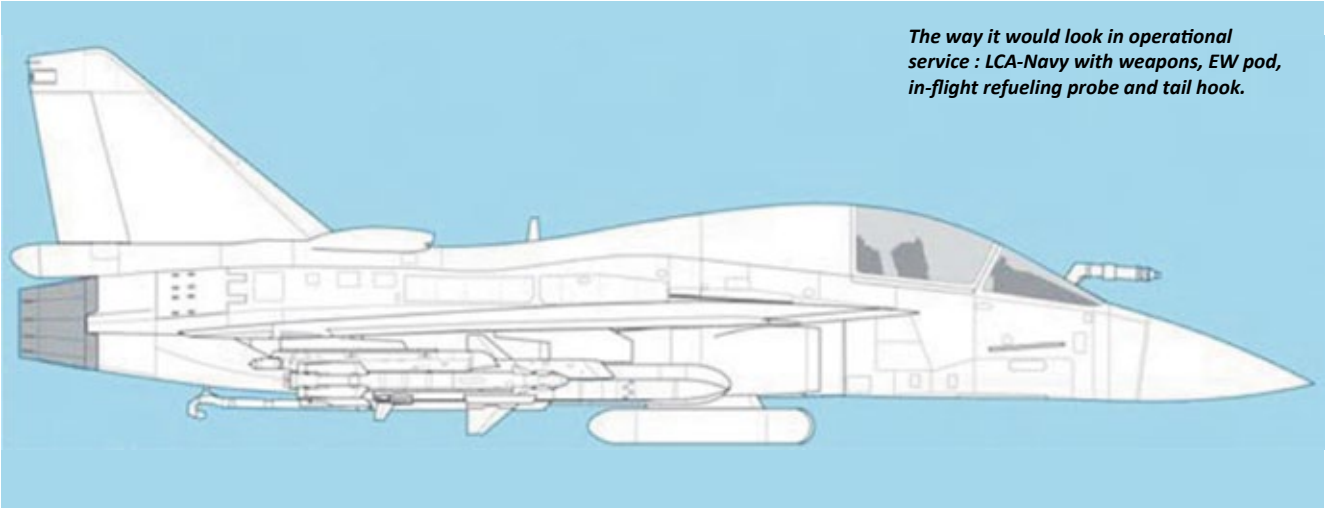
The Prospect

A nation's claim to major-power status does not rest solely on its ability to produce a few nuclear devices, and such claims will ring hollow unless India can create a capability for designing contemporary missiles, aircraft, tanks, warships and submarines, as well as the industrial wherewithal to undertake their indigenous serial production in large numbers.

Before the Sino-Soviet doctrinal falling-out of 1960, the Chinese leadership had ordered the purloining of hardware and designs of every weapon the Soviets had gifted their comrades. Within two decades, China had reverse-engineered and started serial production of everything the PLA needed, from AK-47s to ICBMs and including tanks, the entire MiG family of fighters, submarines and warships for its navy. Today China is a significant arms exporter. By way of contrast, six decades after independence, most of our military hardware remains of foreign origin and India has the dubious distinction of being the top arms importer in the world. Enough has been said about the negative contribution of the DRDO and defence PSUs to this dismal situation - it all seems to fall on deaf ears.

However, it is interesting to note that even as India and China, the two Asian giants, are locked in an unequal competition on many planes (pun unintended) maritime domain that India retains the semblance of an advantage, and in the matter of our 50 year-old carrier-aviation we can count ourselves head and shoulders ahead of China. While the PLA Navy has just commissioned its first re-furbished carrier, the *Shi Lang* (minus aircraft) the IN will be inducting its third such ship in a few months time, while the fourth is under construction in Kochi and the fifth is to follow.

The Chinese have attempted to produce a shipborne aircraft, the J-15 Flying Shark, by reverse-engineering a Ukrainian-made version of the Su-33. However, they have been unable to undertake any flying trials due to non-availability of the Nitka test facility. It is understood that the Russian government, displeased over this violation of intellectual property rights, has directed the sole manufacturer of arrester gear in St Petersburg, Proletarsky Zavod, to deny this equipment to China. Under these circumstances, it is going to be difficult for the PLA Navy to certify the J-15, or even to train carrier pilots, and the Shi Lang may remain just a helicopter-carrier for some years.



The way it would look in operational service : LCA-Navy with weapons, EW pod, in-flight refueling probe and tail hook.

On successful completion of the SBTF phase, carrier compatibility trials will represent two significant challenges for the test team. Firstly, ground manoeuvering (with and without engine power) in the cramped confines of the hangar and flight-deck, while the ship is underway, will call for skill, forethought and planning if mishaps are to be avoided. Secondly, the aspect of ship-motion during launch and recovery will need to be approached with due care and prudence.

In addition to circular motion about three axes (roll, pitch and yaw), ships also tend to, unexpectedly, heave up and down in the vertical plane. Consequently the deck is either not where it was expected to be, or suddenly comes up and slams the aircraft. Often piloting skills are not enough to avoid hard impacts or over-stressing of

Against this backdrop, when the indigenously-designed, manufactured and tested LCA-Navy Mk II lands, first on *Vikramaditya* and then, on the indigenously built IAC-2, it will not just be a significant landmark, but also a rare proof of India's superiority over China in an esoteric field of military technology.

Can there be a better reason to persevere with, and lend full support to, the LCA-Navy?

Smart strategies for defence

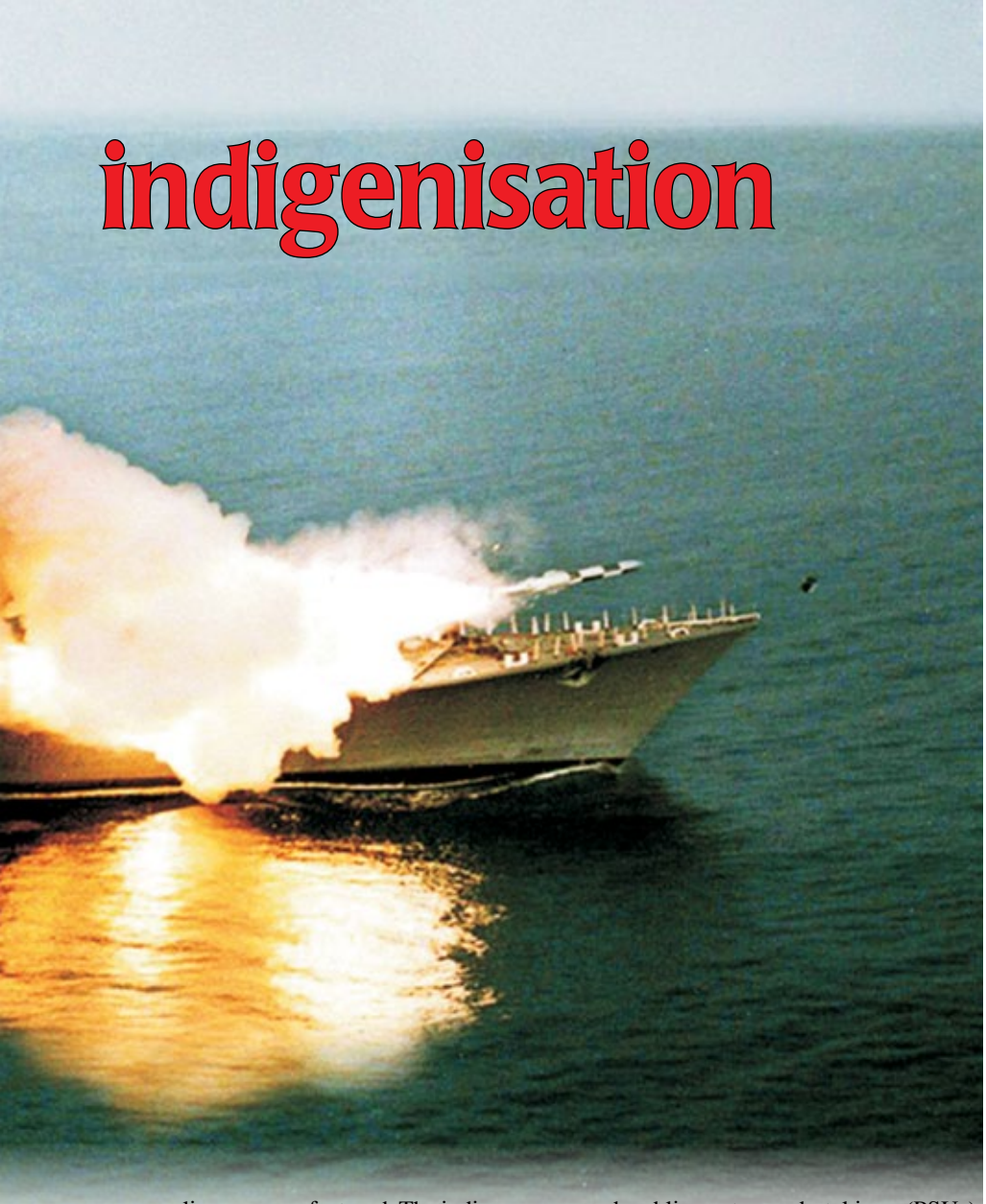
BrahMos firing by INS Rajput

Defence indigenisation is a critical factor providing strategic autonomy to a nation, thereby adding exponentially to national security. Given the specialised and controlled structure of the defence industry the world over, military supplies are high-value goods. Indigenisation provides flexibility by reducing dependency on external sources and frees a country from peripheral pulls and pressures, be it political or technological. The problems associated with dependency on foreign sources were evident after the break-up of the Soviet Union, when the supply of military spares suddenly dried up for India in the 1990s. Having learnt the lesson, an objective of the Indian government since then has been indigenisation of the defence industry.

A number of initiatives have been taken in this direction and presently streamlining procedures such as issue of the Defence Procurement Procedure (DPP), laying down offset criteria issuing letters of intent to private manufacturers and so on have been completed. Evaluation of the Medium Multi Role Combat Aircraft (MMRCA) for the Indian Air Force was carried out based on guidelines in the DPP. Even though this has invited much debate, overriding priority is given to technical considerations which satisfies the Services and augurs well for the future. Actualising procurement decisions into manufacturing has however been relatively slow. On the other hand, there have been successful models such as the joint Indo-Russian BrahMos cruise missile, which has operationalised the technology-to-production cycle in a period of 10 years with a large number of indigenous components. BrahMos has agglomerated the unique expertise of public and private sectors in India and Russia to advantage, engaging not just big players such as Larsen & Toubro but also smaller companies such as Astra Microwave and is planning to expand capacity to over 100 missiles a year. This model exemplifies the scope for indigenisation of the defence industry in India. The concept of industry clusters and defence exports are other pathways for indigenisation which need to be explored. A review of the current status and trajectory of defence indigenisation has, therefore, been undertaken herein.

A general survey of the major weapon systems fielded by the armed forces would reveal a low level of indigenisation. For instance, the Indian Air Force flies a variety of fighter and transport aircraft, such as the MiG-29, Su-30 MKI, Mirage 2000 and IL-76, which have been either bought off the shelf, manufactured from knock-down kits or under licence. The army fields MBTs in the T-series such as T-90 and T-72, which

indigenisation



are license manufactured. The indigenous Arjun MBT remains controversial, though additional orders have been placed for 124 tanks, making a total of 248 such tanks in the years ahead, which will be less than 10 per cent of the overall tank inventory. The Navy continues to depend on French and Russian designs for submarines and frigates, though it has attained a higher degree of indigenisation than the other services and has a well publicised 15-year programme.

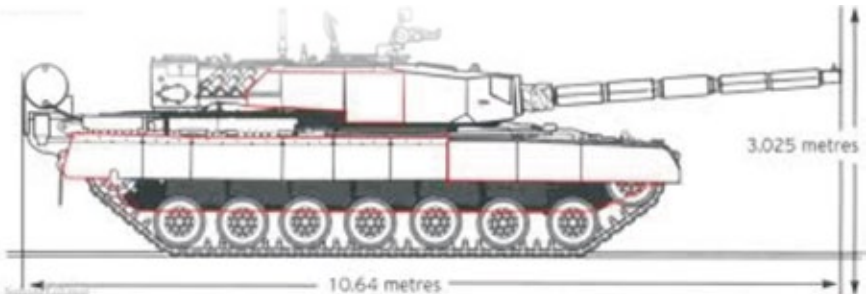
India's self-reliance index (SRI) unfortunately remains low and is estimated to be 0.3 (or 30 per cent) despite the government intent of raising the same to 0.7 (or 70 per cent) by 2005. Some defence analysts as Dr. G. Balachandran, however, contend that the SRI for India from 2001–2008 could be as high as 0.55.1 While this is certainly encouraging information and may be true in terms of payments made to ordnance factories and public sector undertakings (PSUs), a survey of the major equipment held indicates continued dependency on transfer of technology (TOT) as well as licensed manufacture (LM).

First step in the indigenisation route

The indigenisation route followed so far has three primary pathways: indigenous technology development, TOT and LM. It is commonly accepted that the Defence Research and Development Organisation (DRDO) has not been able to meet expectations of indigenising defence technology. With the corporatisation plan now in the offing, it is hoped that some progress would be made in the years ahead. TOT and LM create an unrealistic impression of local manufacture as the intellectual property rights (IPR), including designs, may remain with the foreign manufacturer. One of the reasons for delay in the Scorpene submarine project is attributed to the IPR issues with the French supplier.

Considering the intricacies involved, the government has taken a number of initiatives to promote indigenisation, providing incentives—procedural, financial and structural—to induce Indian as well as foreign companies to establish manufacturing facilities in India. A highly structured defence acquisition organisation is functional, with the defence minister at the apex, and a second-tier under the defence secretary, with the Services represented by the Chiefs and Vice Chiefs, respectively. The Defence Acquisition Wing, with the integration of staff to include the three services as well as defence finance, is the backbone of this system.

Streamlining the process of acquisitions by amplifying the 'Buy,' 'Buy and Make' and 'Make' route through the DPP now provides a well-charted framework for prospective manufacturers. The DPP is also being reviewed frequently to accommodate suggestions by the industry. Thus DPP 2006 was revised in 2008, and amendments in the form of DPP 2009 were followed a year later. A new DPP has since been issued in 2011 which has liberalised offsets. Thus a company can bank civil aerospace and internal security products as defence offsets. Concomitantly a Defence



The Arjun MK.II

Production Policy 2011 has also been issued with focus on indigenisation, thus demonstrating the earnestness with which the government is treating this issue.

DPP 2009 and 2011 liberalises acquisitions to encourage domestic as well as foreign companies by expanding the normal 'Buy,' 'Buy and Make' and 'Make' list to add two new categories, 'Buy & Make (Indian)' and 'Buy (Global)'. Defence Minister AK Antony remarked during the release of Defence Procurement Procedure-2011, "The changes aim at simplification of procedures, speeding up of procurement and enhanced benefits to the Indian defence industry".

'A Buy & Make' decision implies purchase from a foreign vendor followed by licensed production/indigenous manufacture in the country. 'Buy (Indian)' is specifically targeted at Indian vendors with a low ceiling of indigenous content at 30 per cent and 50 per cent on cost basis. The Indian manufacturer has to only carry out integration of the final product. Buy (Global) opens the field for both Indian and foreign vendors, thereby providing an additional outlet for the domestic industry.

Offsets are another route for indigenisation, with DPP 2008 specifying minimum 30 per cent offsets for all purchases over Rs. 300 crore. In the case of the 126 Medium Multi-Role Combat Aircraft, the offset has been set at 50 per cent. The Defence Acquisition Council has the flexibility to prescribe varying offset percentages above 30 per cent and is also empowered to waive off offset obligations in very special cases, depending upon the factors involved, such as the type of acquisition, the strategic importance of the acquisition or technology, the enhanced ability of Indian defence industry to absorb the offset, export potential generated and so on. The vendor is also free to select Indian offset partners and the Ministry of Defence (MOD) may permit change later. As has been brought out, but is reiterated here, DPP 2011 facilitates manufacturers offset obligations in internal security and civil aerospace industry thereby encouraging maximum participation.

To provide a long-term technology and weapons acquisition roadmap to the environment, Headquarters Integrated Defence Staff is required to publish a public perspective document outlining the technology perspective and capability road map covering a period of 15 years, which is to be available on the MOD Web site. (*See article in the Issue*). This is expected to enable long-term planning and investment by companies for technologies, research and development, prototyping and so on. The Technology Perspective and Capability Roadmap 2010 has since been published by the MOD and is available on the MOD Web site.

Operationalisation of processes to manufacturing, however, remains sluggish as these measures have taken almost a decade for fructification, even though impetus for indigenisation was one of the main thrust areas of the Group of Ministers on Management of Defence published in 2001 There is, therefore, a need for greater impulsion in this sphere so that the organisations and processes can contribute to building capacity for indigenisation. With the government's opening up the defence sector for private participation, more opportunities are evident though the perception of preference to the public sector continues as the Defence Ministry has not been able to grant the status of *Raksha Udyog Ratna* (RUR) to major private sector companies as recommended by the Kelkar committee due to resistance from within. There are thus inherent challenges for private companies to compete with the defence public sector undertakings (DPSUs) and the ordnance factories. Despite these three strategies which can contribute to indigenisation, disaggregated manufacturing, clustering and defence exports are being discussed as per succeeding paragraphs.

Disaggregated manufacturing

The Ordnance factories and DPSUs have been dependent on suppliers for providing major as well as minor components and ancillaries with sufficiently large orders, thereby incentivising participation of small manufacturing enterprises (SMEs) in such ventures. The requirements in terms of technology and volumes are not large and attractive enough to attract bigger players. However, the scope is constantly expanding. For instance, as the component of electronics and information technology in military equipment increases, there would be greater opportunities for a number of electronics and IT companies who have developed niche capabilities to participate in defence ventures by providing technology and expertise to the principal manufacturer.

Similarly, the provision of high-technology components for critical systems such as cruise and ballistic missiles can be outsourced to advantage. The original equipment manufacturer (OEM) in this case becomes a systems

ELT

integrator without having to establish major facilities for research and development (R&D) or manufacturing, thereby resulting in substantial savings in production cost. The suppliers being niche players in their respective fields, on the other hand, can develop the requisite R&D as well as technology assimilation facilities in house, thereby facilitating development. Thus, by disaggregating systems into components which can be manufactured by companies having the requisite know-how and expertise within the country, indigenisation can be achieved with ease. Manufacture of the BrahMos is based on this model and is amplified as per succeeding paragraphs.

The Brahmos model

The BrahMos cruise missile project based on disaggregated manufacturing has been able to deliver an operational missile to the Services within a 10-year period. BrahMos was formed as a joint venture (JV) between India and Russia in 1998. India has 51 per cent stake in it and Russia 49 per cent. As per the JV agreement, design and production is to be shared between industries from Russia and India. BrahMos is planning to expand its production capacity to reach a level of 100 missiles per year as against one-fourth of that number being produced at present. Each missile costs U.S.$2.73 million, and BrahMos currently has an order book worth $2 billion and is expecting to enhance the same to $10 billion in the next few years with increased induction by the Indian defence services and expected export orders.

The BrahMos missile has more than 2,000 critical machined components. The production of the missile is being shared by a consortium of public and private industries from India and Russia. The Indian private sector company L&T Mumbai makes the composites. Godrej Aerospace produces the airframe, wings as well as pneumatic and hydraulic systems. Godrej has been selected based on its experience in Launch Vehicle Programmes for ISRO, and five critical assemblies were entrusted to the company to be manufactured and tested. HAL Hyderabad makes the inertial navigation system and the missile checkout system.

The BrahMos TV also exploits the potential of smaller yet high-value technology companies to advantage. Some of these companies are covered in greater detail to see how their core competence has been successfully utilised. For instance, the Aerospace Solutions division of Ananth Technologies, Hyderabad, has offered design solutions in aerostructures. Ananth's Aerospace Division has been one of its core strengths and differentiators since 1992. The division provides both embedded software, hardware and system design. The company claims that through services and solutions offered, aerospace companies achieve faster time-to-market with quality products, cost effectively. The company also claims to offer best-of-breed design solutions in aerostructures and aeroengines for aircraft OEMs and suppliers.

Astra Microwave is another company which uses microwave technology required for missile product range and is working on subsystems for Astra, Pichora as well as BrahMos. Astra Microwave has been offering a range of products for defence, space and civil telecom applications. The company reportedly focuses on defence with the supply of subsystems for radar electronics, missile electronics and EW applications apart from telemetry components. A memorandum of understanding with Astra has enabled BEL to enter into a JV with the Hyderabad-based company for design and manufacture of microwave components and assemblies, thereby providing openings in other sectors. Microwave products are crucial parts of large systems like radars, EW systems, sonars and communication equipment which BEL manufactures. Thus, the collaboration has been mutually beneficial in more areas than one.

Data Patterns is another partner of BrahMos which has expertise in areas of data acquisition and control, automatic test equipment and checkout systems, process automation, digital communication, signal conditioning, manufacturing and industrial automation. These niche areas have come in handy for the cruise missile project. ECIL Hyderabad on the other hand has provided the mobile command post (MCP) and the mobile autonomous launcher (MAL), while BEML Hyderabad has provided high mobility vehicles (HMVs) based on Tatra special chassis.

Russian firms include NPO Mashinostroyenia, which is the prime contractor and has been assisted by PO Strela, Orenburg. NPO Mashinostroyenia as a prime contractor, unites a multidiscipline subcontractor network and has been providing the Russian armed forces with advanced military equipment. The company also collaborates with foreign partners in the military and technical field. PO Strela, Orenburg, on the other hand is said to be a major builder of drones and cruise missiles. Similarly, there are other Russian companies as well such as Granit, St. Petersburg, and Iskra Perm, which contribute to the BrahMos.

In a further development, BrahMos Aerospace Corporation has been formed in Kerala with a $2,400 million (Rs 1,000 crore) investment in the next four years. This is the second unit required to meet orders that are said to be continually increasing. Thus, Kerala Hitech Industries (Keltec) was taken over recently by the MOD for setting up BrahMos AeroSpace (Trivandrum). The new unit is also planning to develop a hypersonic BrahMos missile.

The best of Russian project management skills and Indian ingenuity have thus been employed in the manufacture of BrahMos. The missile project is also a successful example of joint public private partnership in the Indian defence industry, with a number of firms (both public sector and private) working in a consortium to mutual benefit by disaggregating manufacturing. BrahMos is thus a systems integrator, whereas other major firms, both public and private sector, have provided major components of the system. The BrahMos model can be replicated for the indigenisation of other defence equipment as well. Simultaneous, capacity building in the civil sector—say aviation, ship building, automobiles and so on—can be usefully employed to jointly develop and manufacture systems for defence.

Industry clusters

The formation of industry clusters is not a new idea and has been one of the primary drivers for growth in manufacturing. These clusters will comprise R&D laboratories; academic

Saab

and vocational training institutes, which can provide trained scientists, managers and technicians; businesses; suppliers and system integrators who finally roll out the finished product. Ideally, such clusters should be compact. Since the government and the DPSUs in the Indian defence industry are widely dispersed across the country, given the necessity for spreading industrial culture, there may be a need to form functional clusters even as the private sector is going in for geographic ones.

The civil industry in India is already following such a model. For instance, aerospace clusters are planned along a vertical axis, from Nagpur in central India to Hyderabad and Anantapur in Andhra Pradesh; Belgaum, Bangalore and Hosur in Karnataka; and Perambalur in Tamil Nadu. The IT software industry in the south will provide impetus to aviation, thereby generating self-sustaining leverages. The Mumbai–Pune belt, with concentration of automobile industry, provides potential for vehicle manufacturing. Ship building is also similarly leveraged around the five major ports: Mumbai, Panaji, Kochi, Vishakhapatnam and Kolkata. Small arms and armament hubs can be developed around Kolkata or Kanpur, which have a traditional base for such manufacturing, thereby facilitating smooth vertical integration and developing greater capacities for innovation and indigenisation.

Plan view of the Tejas LCA

Defence exports

The capacity of the Indian military to absorb production despite the large size of the armed forces may not generate economies of scale in defence production. There is a need to incentivise defence exports, and India will have to shed traditional inhibitions in this area. Over the past decade or so, emphasis has been laid on expanding defence exports. Chapter VI Para 6.59 of the Group of Ministers Report on Management of Defence has clearly identified the need for focus on defence exports thus:

"The review of the existing Defence Export Policy and ensuring the active involvement of private industry in promoting defence exports, has to be accorded a higher priority. In addition to the expansion of employment opportunities, the economies of scale would help generate both the funds for R&D, and earn valuable foreign exchange. Such exports can also be used selectively for furthering our relationship with target countries. The DP&S is already engaged in an exercise to review the export policy in consultation with other concerned ministries, particularly the Ministries of External Affairs, Finance, and Commerce and private industry. This review must be completed within the next six months."

Despite this clear cut direction, progress on this front has been tardy. The Kelkar Committee, set up to recommend changes in acquisition procedures and facilitate greater participation of private sector in defence production, has also recommended that the current concept of a negative list for defence exports needs a review. It has also recommended setting up an "export marketing organisation" to promote exports. The Foreign Trade Policy 2009–2014 identifies trade as a priority for the country's economic growth. Defence exports can form an important portion of the trade component.

Exports will provide the necessary volumes for investment by the private sector, generating incentives for expansion. Surplus capacities in export can be very effectively utilised for wartime production. There is sufficient demand for military supplies from a range of countries, which includes big ticket items such as main battle tanks and self-propelled guns, armoured personnel carriers (APCs) and armoured cars, surface combatants, aircraft and helicopters, which denotes the capacity in the global market dominated primarily by the United States, Russia and some Western European countries.

Defence exports also have an added advantage of building a long-term strategic relationship between the supplier and the customer, enhancing the country's diplomatic profile as well.

Smart Strategies

Disaggregated manufacturing, clustering and defence exports are three strategies identified for actualising defence indigenisation in India. While these concepts are not new, their application to the Indian defence industry has not fructified so far, and thus an attempt has been made herein to denote the path that can be followed with BrahMos providing a model. India's economic growth trajectory has provided the country space for development in other areas, including defence. The indigenisation of defence will provide the country maximum autonomy to achieve national objectives. While this is not likely to be achieved in the near term, by adopting the strategies suggested, the process can be actualised over a decade or so, thereby expanding India's defence potential and contributing to national security.

Brigadier Rahul K. Bhonsle (Retd.)

PenMan

WINGS FOR THE

Airbus Innovation Days 2012

VAYU visits Airbus' commercial activities in Toulouse

In the last issue of *Vayu* (Issue III/2012) were covered Airbus Military and their programmes in Spain. Now, a look at the Company's commercial offerings including their vision, future concepts, their forecast for India's airlines alongside current programmes—and successes.

After Airbus Military, the very next day these were insights on the commercial side with introductory remarks, updates and discussions with Fabrice Bregier (COO and Designated CEO of Airbus) and John Leahy (COO Customers). This was followed by a product-by-product update, solutions for more efficient operations, cabins and cabin experiences. Over the next 48 hours, we were briefed on future programmes, the A350XWB status and new developments, A320neo and sharklets, status of the A380 and Airbus' focus on human resources.

A surprise guest included in our itinerary turned up to welcome the international media gathered at the Airbus Delivery Centre. He was absolutely delightful spoke like a genius, offered words of wisdom for young entrepreneurs: he was none other than Tony Fernandes, CEO of the Air Asia Group! (He was in Toulouse to receive his 100th Airbus aircraft. But more on him later!)

For those who still an introduction to the company, here goes! Headquartered in Toulouse, France, Airbus is a global

enterprise of some 55,000 employees, with fully-owned subsidiaries in the United States, China, Japan and in the Middle East, spare parts centres in Hamburg, Frankfurt, Washington, Beijing, Dubai and Singapore. Airbus Military is headquartered in Madrid (Spain). Airbus also has training centres in Toulouse, Miami, Hamburg, Bangalore and Beijing, as well as Seville for Airbus Military, and more than 150 field service offices around the world. Airbus also relies on industrial co-operation and partnerships with major companies all over the world, with a network of some 1,600 suppliers in 30 countries.

Statistics: Airbus has sold around 11,600 aircraft to more than 440 customers/operators and has delivered over 7,200 aircraft since it first entered service in 1974. Dedicated to assist airlines enhance the profitability of their fleets, Airbus also delivers a wide range of customer services in all areas of support, tailored to the needs of individual operators all over the world. Over the last 40 years, customer focus, commercial know-how, technological leadership and manufacturing efficiency have propelled Airbus to the forefront of the industry. Airbus today consistently 'captures' about half of all commercial airliner orders.

Airbus' comprehensive product line comprises highly successful families of aircraft ranging from 100 to more than 500 seats: the single-aisle A320 Family, including A320neo, best selling aircraft in aviation history, the wide-body long-range A330 Family including the freighter and MRTT, the all-new next generation A350 XWB Family, and the double-deck A380. Across all its aircraft families Airbus' unique approach ensures that aircraft share the highest commonality in airframes, on-board systems, cockpits and handling characteristics. This reduces significantly operating costs for airlines.

As previously recorded, the military division of Airbus designs, develops and produces a comprehensive range of highly versatile products for military and humanitarian missions. Airbus Military is responsible for the A400M programme, the A330 Multi Role Tanker Transport (MRTT) and for further military derivatives based on Airbus civil aircraft as well as the smaller 'Light & Medium' C295, CN235 and C212. (see Issue III/2012 for a comprehensive article on Vayu's visit to Airbus Military facilities in Spain). Altogether, Airbus Military has sold more than 1,000 aircraft to some 130 military, civilian and governmental customers. More than 800 of these aircraft have been delivered.

The A380 Family starts from a baseline passenger aircraft with a capacity of 525 passengers in a three-class configuration, seated over two decks, and with

a range of 8,300nm/15,300km. Now approaching its fifth year of commercial service and with 253 orders from 19 customers, the A380 fleet has accumulated over 510,000 revenue flight hours in more than 60,000 commercial flights. To date, more than 22 million passengers have flown on the A380.

With seating capacity ranging from 400 to more than 800 passengers, the A380 is an essential part of the solution to sustainable growth, doing more with less: alleviating traffic congestion at busy airports by transporting more passengers with no additional flights and at much lower cost.

With the lowest fuel burn per seat, the A380 allows airlines to substantially reduce their environmental footprint in terms of CO_2 emissions. In summary, "the A380 offers the most comfortable, quietest, most efficient and innovative cabin; the lowest fuel burn, cost per seat, and noise of any large aircraft; it leverages the latest technology, and has been certificated to the very latest standards; it has superior performance, and family development potential. And it is hugely popular with passengers, leading to higher load factors and more revenue, for higher profitability", exuded John Leahy, COO Customers at Airbus.

The A320neo and the

With around 8,400 aircraft ordered, and around 5,100 aircraft delivered to over 330 customers and operators worldwide, the A318, A319, A320 and A321 make up the Airbus single-aisle aircraft family.

The A320neo (new engine option) is the latest of many product upgrades as Airbus continues to invest around 250 million euros a year in the A320 Family and so maintain its position as the "most advanced and fuel-efficient single-aisle aircraft family". These new A319, A320 and A321 models were announced in December 2010 and feature new engines (the PurePower PW1100G from Pratt and Whitney or the LEAP-X from CFM) and large wingtip devices known as Sharklets. Together they result in a 15% fuel burn reduction, corresponding to an annual CO_2 reduction of 3,600 tonnes per aircraft. The A321neo is "the ideal replacement" for hundreds of aging 180 seat aircraft currently in service.

Meanwhile, Sharklets will be available as a forward-fit option from around end 2012 and are expected to result in at least

Saab receives contract extension from Airbus

Saab has received a contract extension from Airbus for the A320-family Aileron for the life of this programme. Based on the current Airbus order backlog for the A320-family the initial contract is valued at 701 MSEK. Saab has delivered ailerons for the wings of the Airbus A320-family since 2000. The company has carried out extensive work aimed at reducing product costs through innovative new design and manufacturing processes for these composite ailerons. Saab has also developed new state-of-the-art CFRP (carbon-fibre-reinforced polymer) monolithic technologies and the concept has reduced the number of parts on the ailerons by over half. Saab has cooperated with Airbus since 1997, and besides delivering ailerons for the A320 family, Saab also delivers the mid and outer fixed leading edges for the A380 and the crew entrance door for the A400M military transport aircraft.

single aisle family

Thales partnership as key avionics supplier for A320neo

Thales has signed an agreement with Airbus which extends its current position onboard the A320neo Family. Thales is progressively introducing enhancements during 2012 to ensure a seamless transition into A320neo Family deliveries, scheduled for entry in service in 2015. Having now secured its position on the A320neo, Thales supplies avionics to every Airbus aircraft, including the A330 Family, A380 and A350 XWB. Thales is also a key avionics supplier to Airbus Military on the A400M programme.

3.5 percent reduced fuelburn over longer sectors, corresponding to an annual CO_2 reduction of around 1,000 tonnes per aircraft. The A320 will be the first model fitted with Sharklets.

The A320 Family profits from the unique benefits of Airbus operational commonality, providing operators with tremendous flexibility in matching the right aircraft to specific route requirements. All A320 Family aircraft share the same 'Type Rating', allowing pilots to fly any of the members of the Family after attending only one training course and enabling the same team of mechanics to maintain the aircraft. With only minimal additional training pilots can transition from these to larger long-range aircraft quickly and simply thanks to the unique Airbus family concept and the exceptional degree of operational commonality. The twin-engine A319, A320 and A321 can be powered by either CFM International CFM56 or International Aero Engines V2500 engines (plus CFM LEAP-X or Pratt and Whitney PW1100G engines from 2015 for the A320neo Family). All A320 Family members are approved for 180-minute ETOPS operations.

Air Asia receives its 100th A320 with special flair

Air Asia marked another milestone on the way to becoming the largest A320 operator worldwide by accepting its 100th aircraft on 23 May, celebrating this event with a special touch that underscores the close relationship established between this low-cost carrier and Airbus. The carrier's latest fleet addition carries the wording: "Thank you Louis Gallois" on its main passenger door, saluting the former Airbus CEO – who completed his current role as the CEO of parent company EADS in end-May.

During a ceremony at Airbus' Toulouse, France delivery centre, the A320 was unveiled in the presence of Gallois, who was welcomed by Air Asia Group CEO Tony Fernandes, and joined by Airbus President and CEO Thomas Enders, along with John Leahy, Airbus' Chief Operating Officer, Customers. Attending the event were members of the international media, who gathered in Toulouse for Airbus' annual Innovation Days event.

"Air Asia could not have reached this point in our amazing story without the tremendous support we've received from Airbus, going back to the start of our relationship in 2004," Fernandes told journalists. "No airline could have grown like ours without the support of such a great partner as Airbus, who has seen us through both the good and bad times."

Air Asia has gone from its origins as a two-aircraft airline carrying 200,000 passengers annually a decade ago to becoming the ASEAN (Association of Southeast Asian Nations) region's leading low-cost carrier, with the goal of transporting 33 million passengers in 2012.

"Gallois has played an enormous role in helping us achieve this growth, and naming the 100th aircraft after him is one way to thank this friend of our airline for his warmth, friendship, patience, and especially his belief – which is a key element at Airbus," he added. "What Airbus did was believe two guys from the music industry who had a dream about making it easier to fly, and they have stayed with that belief in helping us deliver on that ambition and transforming travel in Asia forever."

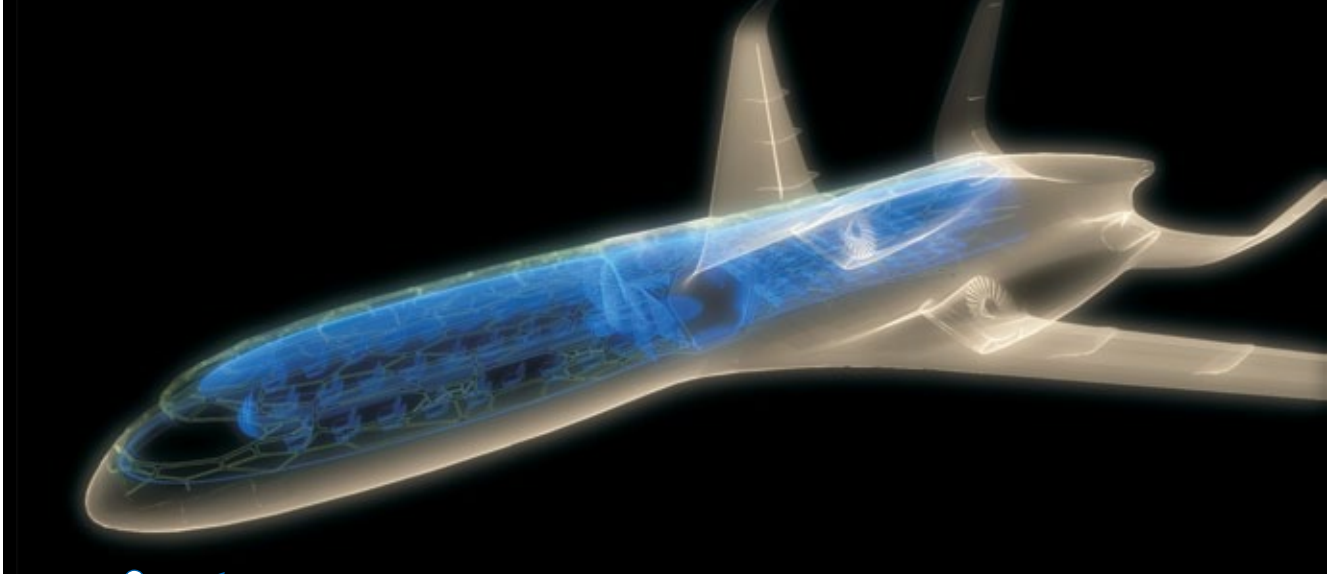
The airline currently has 375 A320s on order, including Airbus' A320neo (new engine option) version. Fernandes said Air Asia's innovative route structure includes 50 percent of routes that were not previously operated by other carriers, with many of these segments using the A320's operational flexibility – including opening access to many airports. "The A320 delivers fantastic reliability, and we work these aircraft very hard: flying them almost 14 hours a day – conducting eight landings and takeoffs, performing turnarounds in 25 minutes," he added.

First new-build Sharklet-equipped A320 completed in Toulouse

Airbus has produced the first new-build A320 with Sharklets. Seen here at its roll-out in Toulouse, MSN 5098 will be one of several A320 Family aircraft in the certification flight-test campaign lasting around 600 flight hours. These Sharklet tests follow the successful 'early flight-test' campaign with Airbus' A320 MSN 001 test aircraft.

In total, seven new-build A320 Family aircraft fitted with both CFM56 and V2500 engine types will test the production-standard Sharklets. The results of the tests will lead up to the certification of these fuel-saving devices on each combination of aircraft model and engine selection. The first member of the family to enter service with Sharklets will be the CFM56-powered A320, from the fourth quarter of 2012.

Sharklets, which have been specially designed for the Airbus A320 Family, will reduce fuel burn by up to 3.5 percent, giving an annual CO2 reduction of around 700 tonnes per aircraft. This is equivalent to the CO2 produced by around 200 cars annually. Sharklets are now offered as an option on new-build aircraft, and are standard on the A320neo Family.



Airbus Research and Technology

Since the introduction of jet engined aircraft, the air transport industry has achieved enormous improvements in economic efficiency and environmental performance of aircraft. For instance, in the last 40 years, the aviation industry has cut fuel burn and CO_2 emissions by 70%, NOx emissions by 90% and noise by 75%. During that time, innovation has been a key driver in Airbus' success. From the A300 to the A350 XWB, Airbus has been continually implementing new ideas.

Environmental and safety considerations have long been an integral part of the company's activities at all levels, and are a key priority in the development of all new techniques, products and processes. Through innovation, and out-of-the-box thinking, Airbus will continue to meet its eco-efficiency goals, and ensure that air travel continues to be one of the safest–and most eco-efficient means of transportation. That's where Research and Technology (R&T) comes in. Innovation is the backbone of Airbus' ongoing success and the key to its future.

Working together with governments, industries, research institutes and universities around the world, Airbus is focused on finding the best solutions for some of aviation's most important questions thus meeting and even going beyond customers' and society's needs. To satisfy these, the technologies and innovations need to deliver a significant improvement, a step-change in efficiency and performance and will benefit and contribute to the growth of the industry on a global scale.

More than 3,000 people at Airbus are working either directly or indirectly on over 400 R&T projects that are regrouped into 100 major ones to further improve efficiency. Above 90 percent of Airbus' annual R&D investment of over two billion euros has environmental benefits for current and future aircraft. Airbus files more than 600 patent applications each year.

Over the next 40 years, R&T cooperation and investment will be even more crucial because energy sources are set to become increasingly scarce and expensive, yet

fuel remains the single biggest element of airline operating costs (30% for single aisle/ 40% for long range aircraft), so reducing consumption (and therefore emissions) and finding new alternative sources remains a key industry driver. The aeronautics industry needs further step-changes in economic and environmental performance throughout the aircraft lifecycle to address the challenges.

Airbus' R&T efforts are achieved on a global scale. Not one single party or nation working on its own could have achieved what Airbus has collectively achieved. R&T investment stimulates economies: it is estimated by governments and institutions alike that a €100 million investment in aeronautics R&T raises GDP by €700 million over 10 years, and has a spin-off effect spurring breakthroughs in many other industries. Secondly R&T ensures stability: investments drive economic growth, creativity and education by reaching out to the younger generations and encouraging them to choose the science and engineering field.

Another important and innovative development was the official start of work as part of the seven-year European Union 'CleanSky' Joint Undertaking in which Airbus and Saab are leading the Smart Fixed Wing Aircraft (SFWA) Integrated Technology Demonstrator (ITD). The programme's objectives are closely related to the four environmental challenges set by the Advisory Council for Aeronautics Research in Europe (ACARE): to reduce fuel consumption and CO_2 emissions by 50 percent to reduce perceived external noise by 50 percent and to reduce NOx by 80 percent by the year 2020.

In emphasis Airbus places priority on R&T topics which they believe can be game changers in the area of large commercial aircraft for the future of Air Transport. The key motivation is to really achieve a substantial improvement with respect to environmental issues. For example, to lower the drag of the aircraft and to thereby improve the efficiency and to include and to integrate the most advanced and efficient engines that they can find on the market. And if they are not on the market, then Clean Sky aims to be the major enabling programme to encourage the engine manufacturers to develop them.

Jet Airways A330-200 (photo: Tommy Desmet)

"India needs over 1,040 aircraft worth $145 billion in next 20 years"

According to the Airbus' latest market forecast, Indian carriers will require 1,043 new passenger (1,020) and freighter (23) aircraft valued at US$145 billion between now and 2030 to satisfy surging annual demand. India's market for new aircraft makes it the world's fourth largest both in number of aircraft and value.

Indian annual passenger traffic growth rates of 7.2 per cent are well above the regional Asia Pacific average growth rate of 5.9 per cent and the world average of 4.8 per cent.

Of the requirement for 1,020 new passenger aircraft, some 860 will be for growth and 160 to replace the eldest aircraft in the existing fleet of 327. By 2030, this means that India's passenger fleet will more than triple to some 1,180 aircraft. The new passenger aircraft include 646 single aisles like the A320 and A320neo Family, 308 twin aisles like the A350 XWB and A330, and 66 very large aircraft such as the A380.

Growing urbanisation and population concentrations combined with a growing middle class and dynamic economic growth are driving demand and this trend is expected to continue. Despite near term challenges, the Indian economy is forecast to continue expanding, helping India's growth in domestic air travel to reach even higher growth rates of nearly 10 per cent annually, making it one of the fastest growing aviation markets anywhere in the world.

An Air India A321 (photo: Weimeng)

"By 2030, India's economy is forecast to be the fourth largest in the world creating exceptional potential for growth in the aviation sector. Through our Indian industrial partnerships we are proud to boast that every A320 today is partly made in India," said Dr. Kiran Rao, Airbus Executive Vice President, Sales and Marketing, and President of Airbus India. "Our engineering and industrial footprint in India supports over 2,000 highly skilled Indian jobs throughout our supply chain, and this figure is growing."

Cabin interior of the XWB

A350 on the assembly line.

Fast progress on the A350 XWB

The A350XWB is an all new family of mid-sized wide-body airliners to shape the efficiency of medium-to-long haul airline operations, overcoming the challenges of volatile fuel prices, matching rising passenger expectations and addressing increasing environmental concerns. To date the type holds 548 firm orders from 34 customers.

The A350 XWB Family consists of three passenger versions with true long-range capability of flying distances of up to 8,500nm/15,580km. In a typical three-class configuration, the A350-800 will offer 270 seats while the A350-900 and the A350-1000 will offer 314 and 350 seats respectively. With one aircraft available in three different sizes, airlines can best match their A350 XWB fleets to route capacity demands, guaranteeing optimum revenue potential. Pilots can fly all three versions with the same certification, further maximising airline profitability.

"The A350 XWB offers a very quiet and extremely comfortable cabin. At 220 inches/5.58 meters from armrest to armrest, the cabin provides a wide 18 inch seat in-line with the best comfort standards. Passengers will enjoy more headroom, wider panoramic windows, and larger overhead storage space. Crews will be able to relax when off-duty in extremely comfortable crew rest compartments located in the crown area, well outside the revenue generating cabin space."

The A350 XWB brings together the very latest in aerodynamics, design and advanced technologies to provide a 25 percent step-change in fuel efficiency. Over 70 percent of the A350 XWB's weight-efficient airframe is made from advanced materials combining composites (53 percent), titanium and advanced aluminium alloys. The aircraft's innovative all-new Carbon Fibre Reinforced Plastic (CFRP) fuselage results in lower fuel burn as well as easier maintenance.

Next generation Rolls-Royce Trent XWB engines and state-of-the-art aerodynamics help reduce emissions well below current and anticipated future regulatory levels. Carbon dioxide (CO_2) emissions per passenger will be up to 25 percent lower than with current generation aircraft in this category and exterior noise levels will be as much as 15 EPNdB (Effective Perceived Noise Decibel) below ICAO Chapter-4 requirements.

Final assembly of the first A350 XWB is now underway at the brand new final assembly line in Toulouse. This latest step in the A350 XWB's progress is achieved as Airbus starts joining the 19.7 metre long centre fuselage with the 21 metre long front fuselage. This first A350 XWB airframe will be used for the static structural tests that all new aircraft undergo as part of their certification process. The assembly of the first flying A350 XWB, MSN1, will start during the summer of 2012.

The centre fuselage was delivered to Toulouse on 4 April 2012 by Beluga from Airbus in St Nazaire, France. The front fuselage was previously delivered from St Nazaire to the A350 XWB final assembly line on 23 December 2011. Delivery and installation of the aft fuselage from Hamburg, Germany will take place in the soon followed by the wings delivered from Airbus' wing assembly site in Broughton, UK.

The A350 XWB fuselage is made up of three main sections : front, centre and aft. These will be joined together at the first main assembly station, Station 50. The nose landing-gear is also joined here. Once this stage is completed, the fuselage is transferred to Station 40 where the wings and tail sections are joined. In parallel to this, cabin installation will be carried out simultaneously to the wing-fuselage join up, as well as the "power on" of the aircraft systems. In this way, functional tests can start earlier than on previous programmes. Full speed ahead!

VSC

.. and the latest from Airbus Military

Continuing developments since Vayu's Issue of May-June/2012

The A400M at Farnborough Air Show

Based on the current flight test schedule and planning, Airbus Military brought the first production representative example of the A400M - the MSN6 - to the Farnborough Air Show 2012. The aircraft was on static display, allowing a maximum number of current and potential customers and other visitors to view the production standard cargo-hold and appreciate the real dimensions of the aircraft without flight-test instrumentation for the first time.

A400M flight testing continues at an aggressive pace with successful achievements in the field of military capabilities. "It is beginning to show the level of technical maturity required at first delivery, and we are pleased with the overall performance of the aircraft. Despite some engine maturity challenges, we are confident that we will find the right solutions and provide our customers with an aircraft that fully meets or exceeds the expectations", stated Airbus officials.

By the end of June, the A400M had completed 1180 flights and 3535 flight hours in flight-test since its first flight in December 2009. In recent months, flight test progress has been "good" with successful tests in the areas of air-to-air refueling as a receiver and a tanker, loading of helicopters on board and the first testing of the defensive aid systems. The industrial status is on track with the first three customer aircraft now in the final assembly process in Seville and a further six aircraft in various stages of production with long-lead items launched up to MSN19.

Unique formation flight

At the unique occasion of having the five Airbus Military A400M flight test aircraft in Toulouse all at the same time, the Airbus Military Flight Test team put in place a formation flight of all the five aircraft, after which each aircraft continued its specific flight test activity. This technical flight of the five 'Grizzlies', MSN1, 2, 3, 4 and 6, crewed with Airbus Flight Test teams but no particular manoeuveres or tests were undertaken. Following the formation exercise, the different aircraft continued on their daily activity: MSN1 continued with handling quality tests, MSN2 with air-to-air refueling wing pods hose stability tests, MSN3 with engine performance tests, MSN4 with pressurisation and oxygen tests and MSN6 with function and reliability tests.

Cameroon Air Force orders CN235

The Cameroon Air Force has ordered a single CN235 medium transport aircraft, a robust aircraft with a six tonne payload that is well-proven in hot, dusty and humid conditions throughout Africa. "It is flexible and reliable with good short take-off and landing capability, and its cabin can be easily reconfigured for a variety of transport missions such as carrying troops, cargo, mixed loads or for medical evacuation." The aircraft will be used to modernise the Cameroon Air Force's transport fleet.

"Airbus Military is proud to have gained the confidence of the Cameroon Air Force and looks forward to standing by our customer as a trusted partner for many years to come", said Antonio Rodriguez Barberán, Airbus Military VP Commercial. "The CN235 is exactly the kind of workhorse required for current and future airlift missions to be performed by the Cameroon Air Force and we are optimistic that its in-service performance will lead to further orders from Cameroon."

A400M demonstrates loading of helicopters

The photo shows an EC725 on board the A400M.

Airbus Military has successfully demonstrated the loading of NH Industries NH90 and Eurocopter EC725 helicopters onto the A400M new generation airlifter. In a series of tests at Holzdorf air base in Germany and at Toulouse, France respectively, the NH90 and EC725 were loaded onto, and unloaded from, the Grizzly 4 development aircraft as required for military Initial Operating Capability (IOC). The tests were the first demonstrations of the A400M´s cargo-carrying capability using a real aircraft, and represent the most challenging loads in terms of their dimensions required for IOC. This will be followed by further exercises showing the aircraft´s ability to carry a wide range of military equipment as required by the launch nations.

Poland orders five C295s

The Polish Air Force has signed a contract with Airbus Military for the acquisition of five C295 transport aircraft to further expand their transport capabilities. Deliveries will start end of this year and continue into 2013. The aircraft will join the existing C295s currently in service, increasing the fleet to 16 aircraft, and will be used to support the Polish Air Force in its national and international operations.

"The C295 is working extremely well with the Polish Air Force and we are proud to have a further vote of confidence from our customer with this new order for a further five aircraft. We have a very close relationship with Poland also through our Polish subsidiary and we look forward to further expand our footprint in Poland", said Domingo Ureña Raso, CEO of Airbus Military. "This order also underlines our leadership in this segment with over 110 orders of which 27 orders were placed this year."

The Farnborough Air

A 'Flash Mob' with the A380 in the background!

Damp — but Determined!

Yet another show in Hampshire where it rained all the time! Dark clouds hung overhead Farnborough making flying – and photography – difficult. English weather! In between when the sun came out, there was brisk flying activity, people hurrying to get to the next chalet/ hall or just rushing to grab a quick bite from the numerous food trailers. By the third day of the rainy event, visitors did not seem to care anymore and could be sitting on wet grass witnessing thunderous take offs!

show 2012

Overall, there seemed to be a general lack of airshow buzz and excitement compared with previous events. Still, all that talk of an economic doom and gloom did not reflect the final order tally: $72 billion dollars of orders signed! ADS, the UK's AeroSpace, Defence and Security trade organisation and its subsidiary company Farnborough International Limited (FIL) announced the order figure at end of the five days.

The Farnborough International Airshow also contributes about £20 million to the local economy around Farnborough through the contribution from international visitors and companies. Airshow organisers, FIL also confirmed that over the five days of the show, the event attracted just over 107,000 trade visitors and over 1500 exhibitors with representation right across the supply chain. Over 70 military delegations from 46 countries attended with a further 13 delegations from the civil sector. Farnborough 2012 also had good engagement from decision-makers with the UK Prime Minister David Cameron at the show, a further 6 Cabinet members making keynote speeches, as well as senior ministers from the UK and overseas. Orders placed at the show as mentioned before was $72 billion: significantly up on the orders for 2010 which totalled $47

ITT Exelis showcases leading defence technologies

Farnborough 2012 marked the company's first appearance as ITT Exelis, following its spin-off from ITT Corporation in October 2011. "As a standalone company, Exelis is more agile in anticipating customers' evolving needs and in providing affordable capabilities and ready-now, high-technology solutions to military, government and commercial customers around the world", stated company officials. Exelis is a leader in networked communications, sensors, air, sea and ground electronic warfare, composites, air traffic solutions, information/cyber solutions and space and C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance).

The Red Arrows with a lone Vulcan Bomber.

billion; at its peak in the boom year 2008, orders had touched $88.7 billion.

Over 140 aircraft took part in the static and flying displays at the Farnborough Aerodrome in Hampshire including the Boeing 787 Dreamliner which flew on the first three days of the show – a Boeing and Farnborough first – with the Airbus A380 in attendance for the full seven days. Flying display highlights included the Bell Boeing V22 Osprey, Saab's Gripen and the Korean T50 jet trainer.

Rees Ward, CEO at ADS said: "The 2012 Farnborough International Airshow has been exceptionally successful and the figures demonstrate the growing mood of optimism that has been around the show this year, which is very encouraging given the current global economic climate. To have over $72 billion worth of business

Cassidian MSR 1000s for French Armed Forces

Cassidian, the defence and security division of EADS, will supply the French Armed Forces with advanced identification systems used to prevent friendly fire. The French defence procurement agency (*Direction Générale de l'Armement* – DGA) recently awarded Cassidian a contract to supply 150 units of its newly developed MSR 1000 I interrogator (MSR Monopulse Secondary Radar) for the short-range friend-or-foe identification (IFF). The first units will be delivered by mid-2014. They are destined for installation on the Army's MISTRAL missile launchers and MARTHA air defence command and control stations as well as on the armoured launch vehicles of the Air Force's CROTALE NG missile. The contract is a part of the IFF NG (New Generation) operation, which sets out to develop equipment compliant with NATO's new Mode 5 interoperability standard. This will offer the French Armed Forces the option of upgrading their platforms.

Airliners and derivatives on static display.

done and so dramatically improving on 2010's figures is great news for a global industry. It demonstrates a similar pattern shown in the UK's Aerospace industry which generated £24 bn in 2011 – an increase from £23 bn in 2010. With exports accounting for 75 per cent of total UK aerospace sales, the business done at Farnborough can only mean further work for our world-beating industry. The high level of support and engagement from Westminster led by Mr Cameron being the first Prime Minister to open the show in living memory, only demonstrates the commitment and willingness of Government to ensure the success of a sector that can rightly claim pole position as Europe's leading aerospace exporter".

It may have been Boeing's turn to shine at this year's event, out-selling Airbus with orders and commitments for 396 aircraft versus Airbus' 115 new sales and commitments, but it was the prominence of aircraft lessors in the order-making that was the real talking point. Aircraft lessors were prominent during the 2012 Farnborough International Airshow, accounting for approximately 46% of the commitments and pledges covering 627 aircraft. Apart from the 150 aircraft order announced during the event by United Airlines in Chicago, lessors represented nearly 61% of the business agreements tabled at the show. Leasing company customers Air Lease Corporation, GECAS,

An aerial view of the aircraft on display.

GE and CFM have a great Show !

Orders for engines and services from GE and its joint venture CFM International at the 2012 Farnborough Airshow totaled almost $17.5 billion. "The results from this year's show are proof that GE Aviation and CFM International are on the right technology paths with our engine programmes and service offerings," said David Joyce, president and chief executive officer of GE Aviation. "Our customers are embracing our product with their orders and we look forward to delivering on these significant commitments."

"The air shows are much more than a forum to announce orders. They're an opportunity to take the pulse of the industry, and I picked up a strong pulse this week," said Norman CT Liu, president and chief executive officer of GE Capital Aviation Service (GECAS). "Despite today's economic environment, airlines are looking for newer, more fuel efficient aircraft," said Norman CT Liu, president and chief executive officer of GE Capital Aviation Service (GECAS). "Our strategic orders the last two years position GECAS well to meet that demand."

ALAFCO and Avolon announced orders and commitments at the show for 220 737-family airplanes.

Such results reflect salient growth of the aircraft leasing business during the last decade as airlines see their ability to secure credit dwindle and banks preferred to forge financing deals with lessors with increasing portfolio diversification that lowered their risk profile.

A direct result of the rise of lessors in importance is the share of the world's commercial aircraft fleet financed through operating leases which has grown from 25% to 35% since 2000, according to rating agency Fitch. "Aircraft lessors have filled important financing gaps that grew as debt capital markets tightened and airline credit quality weakened," the company recently concluded. Boeing estimates that between 1970 and 2000 the percentage of the global commercial aircraft fleet on operating lease grew from less than 1% to 36%.

EADS Group present innovative products

From commercial and military aircraft to satellites and secure communications systems, EADS and its divisions – Airbus, Astrium, Cassidian and Eurocopter – presented a wide array of innovative products. In the flying display, Airbus' flagship A380 made a welcome return to Farnborough along with Airbus Military's A400M turboprop transport aircraft that has been ordered by eight nations. Making its first appearance was Eurocopter's EC175, a new medium twin-engine helicopter. A Royal Air Force Eurofighter Typhoon also appeared in the aerial display. EADS is a partner in the Eurofighter consortium. On the static display, there were a number of other aircraft including an Airbus A320 equipped with fuel-saving Sharklet devices on its wing-tips, an A318 Corporate Jet and the A300-600ST Beluga aircraft used for transporting oversized cargo. A Portuguese Air Force C295 maritime patrol aircraft was there too.

In the product exhibition area of the Pavilion, Airbus presented models of its future A350 XWB aircraft and C295 in the Airborne Early Warning & Antisubmarine Warfare configurations. Eurocopter meanwhile presented a model of the EC175 and the highspeed hybrid demonstrator, the X3. Astrium, the space division of EADS, displayed a number of exhibits including a model of its Skynet 5 UK military communications satellite system as well as the airborne satellite communications terminal, AirPatrol.

RUAG Aviation and GE broaden ties

Philipp Berner, CEO of RUAG Aviation, Konrad Peter, executive chairman of RUAG Holding and Tony Mathis, vice president and general manager of Turbofan/Turbojet Projects for GE Military Systems Operation have extended a business agreement to further broaden industrial development activities in Switzerland. The agreement includes GE's F414 engine, which powers the Boeing F/A-18E/F, Saab Gripen E/F and other aircraft.

Bell Helicopter showcases its Relentless

Bell Helicopter provided flight demonstrations, had two commercial aircraft on display, and showcased the mock up of its new Bell 525 Relentless super medium helicopter for the first time in Europe. "Farnborough marks the European debut of our new Bell 525 Relentless helicopter following a successful launch in February at HeliExpo in Dallas, Texas. We are excited to give our customers in Europe the opportunity to see our mock up of this game-changing aircraft," said John L. Garrison, President and CEO of Bell Helicopter. "We are on a mission at Bell Helicopter to enable our customers' success by investing in new products that provide our customers innovative, reliable and affordable solutions. We win by listening to our customers' needs and by acting upon them. The Bell 525 Relentless and the revolutionary V-22 Osprey are direct outcomes of exactly that – listening and acting."

Bell Helicopter presence included the Bell 429 in corporate configuration, a Bell 429 in Emergency Medical Services configuration and the Bell 407GX in corporate configuration.

Bell 525 Relentless at the Textron pavillion

Irkut

Cassidian, the defence and security division of EADS, demonstrated its capabilities in areas such as border security and surveillance, cyber security and training services, particularly in the field of air systems.

EADS Innovation Works, which operates EADS' Corporate Research and Technology laboratories around the world, displayed a variety of technologies that it is pioneering and are likely to be incorporated widely in future aircraft designs. These included a model of a portable UAV produced using Additive Layer Manufacturing (ALM) technology, which is also known as 3D-printing.

Airbus won about US$16.9 billion worth of business for a total of 115 aircraft. The commitments comprised Memorandum of Understanding (MoU) for 61 aircraft worth US$5.8 billion and firm purchase orders for 54 aircraft worth around US$11.1 billion.

The A350-1000 was notable star at the show, receiving a significant endorsement from one of the world's foremost carriers, Cathay Pacific Airways. The airline not only placed 10 new orders for the model, but also converted 16 previously ordered A350-900s to the new larger variant. This represents almost US$4.2 billion worth of business. The A350-1000 ordered by Cathay Pacific features the recently enhanced Rolls-Royce Trent XWB turbofan with 97,000lbs thrust.

The A330 Family won 10 firm orders worth US$2.3 billion from CIT Group. This order is additionally significant since it marks the launch of the new upgraded 240 tonne take-off weight A330. The A320 Family also scored at Farnborough by winning 86 commitments worth over US$8.4 billion.

Boeing highlights advanced ISR technologies

Boeing's 787 Dreamliner participated for the first time in flying displays at the Farnborough International Airshow; the company also presented its Enduring Awareness Pavilion, a comprehensive display of advanced command, control, communication, computer, intelligence, surveillance and reconnaissance (C4ISR) capabilities. "We are showcasing a full range of innovative new products, systems and services from our commercial, defence, space and security businesses," said Tom Downey, senior vice president, Boeing Communications. "We're looking forward to the opportunities the Show provides to meet with customers, partners and other stakeholders".

A Boeing 787 Dreamliner in Qatar Airways livery was on static display. In addition, Korean Air displayed its newest Boeing 737-900ER. The company featured the new 737 MAX with a programme update and a full-scale model of the 737 MAX Advanced Technology winglet on view in the Boeing static display area.

The *Enduring Awareness Pavilion* was an interactive exhibit focused on C4ISR across every operational domain – air, land, sea, space and cyberspace. It showcased more than 20 technologies – including the P-8A Poseidon, Space-Based Space Surveillance system, Airborne Early Warning and Control, eXMeritus HardwareWall, unmanned airborne systems from ScanEagle to Phantom Eye, and other capabilities.

Bell Boeing V-22 Osprey tiltrotor

Elbit Systems Introduces J-MUSIC

Expanding its suite of advanced directed infra-red counter measures (DIRCM) systems, Elbit Systems introduced the new J-MUSIC DIRCM System, specifically designed and optimised to protect medium to large aircraft. Based on the same proven technologies of the C-MUSIC system, selected by the Israeli Government to protect passenger aircraft, J-MUSIC is an advanced multi-spectral infra-red fiber-laser based DIRCM system, which rapidly acquires and tracks incoming man-portable missiles (MANPADS) and deflects them from the target using a very powerful laser beam. The new system is specially designed to protect medium to large jets such as transporters, tankers, special mission platforms, business jets and others.

The Elettronica theme : high technology and innovation

Elettronica, one of Europe's leading manufacturer of electronic defence equipment, designs and manufactures a wide range of EW technical solutions for naval, land and air missions: ESM, ECM, ELINT, RWR, SOJ, EJ and Cyberattack. Every aspect of defence electronics (EW) is thoroughly managed, from passive monitoring of electromagnetic emissions – both in asymmetric and symmetric combat conditions, in peace, tension and wartime - to self, mutual and stand-off protection of combat and support platforms, to the analysis of complex battlefield scenarios for tactical and intelligence purposes.

"Elettronica has always been a unique case on the Italian defence industry scene" President & CEO, Mr Benigni stated, adding: "Thanks to its small size and its largely private shareholding structure, it enjoys a degree of operational flexibility that the large groups have never had. The highly technological nature of its area of activity, the "force multiplier" effect of its products and its leading position on the Italian market have given it a strategic value that goes well beyond its size, both nationally and internationally".

Over the years, Elettronica has supplied over 2700 of its products for airborne, naval and ground platforms, it has an order book of €1.168 M, a capital stock of €9 M and its revenues increased from €173 million in 2007 to €197 million in 2011. "Obviously, the ability of providing constant support to customers is largely dependent on the development of new technologies, which are necessary to deliver the best products and updates in line with customers' demands. For this reason, Elettronica invests 10% of its resources in R&D, and collaborates with universities and research centres to develop ideas and projects which will become future and real solutions available to ELT's customers".

To emphasise the Company's activities and capabilities, Elettronica's stand at Farnborough International 2012 presented a range of products that illustrate benefits of implementing the most advanced technologies developed by Elettronica and applied in its products such as Virgilius. Virgilius is an advanced, fully integrated electronic warfare system particularly suited to airborne applications such as air-to-air and air-to-surface operations. On display was the ELT/572 (DIRCM) which can be integrated with any suitable Missile Warning Systems (MWS) already present onboard the platform, or can be supplied together with its own IR-based Missile Warning and Tracking System. Another innovation, the ELT/800 is an ELINT equipment design for fixed and rotary wing applications based on a Wide Open and SH Digital Receiver architecture through a unique system approach and modern technologies. The system allows Tactical Surveillance (ESM function) and highly accurate data processing for intelligence analysis purposes (ELINT function). The ELT/800 is a compact and light weight solution providing a considerable installation fl exibility. Fully compatible, this can be deployed on any legacy and future generation of airborne platforms.

Alenia Aermacchi and ATK introduce the new MC-27J

Alenia Aermacchi have introduced a new version of the C-27J tactical airlifter, the MC-27J: a multi-mission, armed, Roll On/Roll Off (RO/RO) derivative of the C-27J Spartan. The MC-27J is designed to support air forces and Special Forces in performing several key operations, including anti-terrorism missions, evacuation of military personnel and civil populations from crisis areas, fighting asymmetrical threats and for all standard operations of the Special Forces.

The MC-27J provides Special Forces a platform with quick transfer speed; long operational range and ample cargo capacity (console for the systems' operators, troops and vehicles).

ATK's gunship capability is provided from a newly developed palletised weapons system, which is self-contained, modular, scalable and provides RO/RO flexibility. This palletised system integrates sensors, communications and weapons into a responsive and reconfigurable mission package. Specific features for the MC-27J system include enhanced electro-optical/infrared targeting sensors, a trainable 30mm cannon, precision guided munitions, advanced communications and a networked mission management and fire control system.

First qualification firing test of Sagem's Hammer

Sagem announced that the French defence procurement agency DGA had successfully carried out the first qualification firing test of the laser terminal guidance version of the AASM Hammer modular air-to-ground weapon built by it. The test was carried out by the DGA's missile test department at the Cazaux air base on 31 May, with the Hammer weapon being fired from a production Rafale fighter. The target, a bridge pier located more than 50 kilometers from the release point, was illuminated by an airborne illuminator that was activated during the last few seconds of the weapon's flight. The

GPS/inertial/laser guidance version, designated SBU-64 Hammer, joins the AASM range which already includes two other versions qualified for deployment by Rafale: GPS/inertial and GPS/inertial/infrared versions. The SBU-64 features a semi-active laser seeker in place of the infrared imager, plus dedicated algorithms that are activated during the terminal phase. This version of the AASM can be used to attack moving targets.

The French armed forces will start taking delivery of the AASM SBU-64 at the end of 2012, as part of a contract that provides for the production of several hundred units.

Eurocopter: focus on mission operability

Eurocopter's participation at the 2012 Farnborough Airshow highlighted the capabilities of the company's growing rotorcraft family including the new EC175, a new seven metric ton-category helicopter. For its appearance at the biennial UK industry event, the EC175 was exhibited on the static display and took part in daily flying demonstrations.

The company also displayed 1:5 scale models of the EC175 and X3 high-speed hybrid aircraft, the latter of which is currently undertaking an extensive U.S. demonstration tour for military, parapublic and civilian operators.

EC175s

During the show's daily flying display, Boeing demonstrated the capabilities of its multi-role F/A-18E/F Super Hornet fighter. Also on the flying programme were the Bell Boeing V-22 Osprey tiltrotor and the C-17 Globemaster III airlifter. The company and its customers also displayed several other systems, including the F-15E Eagle fighter and the AH-64D Apache Longbow attack helicopter.

Bombardier's successful show

Bombardier Aerospace concluded a successful week where it had the opportunity to connect with business and commercial aircraft customers from around the world and announced up to $3.27 billion in firm orders and other commitments for its Q400 NextGen, CRJ and CSeries aircraft. "We arrived at Farnborough with solid momentum following a strong first half of the year, and I'm delighted with the success we have had this week," said Guy C. Hachey, President and Chief Operating Officer, Bombardier Aerospace. "This airshow is a wonderful opportunity for us to connect with our stakeholders across the industry, and I'm very pleased with the level of interest and activity we're seeing in all of our aircraft programmes and services."

"We have had a tremendous volume of traffic in our chalet, the CSeries Dome that houses the CSeries aircraft cabin demonstrator and flight deck, and the static display. We have proudly introduced our new brand promise, *The Evolution of Mobility*, to customers, suppliers, government representatives, industry partners and members of the media that we interacted with over the course of the week," added Mr. Hachey.

Since 7 July, Bombardier Commercial Aircraft announced firm orders and other commitments for up to 52 aircraft worth up to $3.27 billion US with China Express Airlines, Air Baltic, Jazz Aviation LP and an undisclosed customer. Bombardier Commercial Aircraft has had a great start to 2012 with 154 orders, including firm and conditional orders as well as options, from 11 customers from across the globe.

The airshow was also an opportunity for Bombardier Business Aircraft to continue or start discussions with multiple customers and provide an update on its Learjet aircraft development programmes.

CFM receives $12.6 billion in new orders

The momentum for CFM Internationals' advanced LEAP engine family continues to build up as the company logged orders and commitments for 922 new engines in recent weeks at a value of $12.6 billion at list price, nearly doubling its total 2012 order book to date, which now stands at 1,792. Orders came for LEAP engines for Airbus A320neo, Boeing 737 MAX, and COMAC C919 and CFM56 -5B and CFM56-7B engines to power Airbus A320 and Boeing 737 aircraft.

'Leap' at the CFM stand at Farnborough 2012.

L-3 WESCAM provides shipborne electro-optical/infrared imaging turrets

L-3 WESCAM has received an order from Austal for 10 shipborne versions of the MX-10 electro-optical/infrared (EO/IR) imaging system, which will be fitted to new patrol boats being built for the Australian Customs and Border Protection Service. Deliveries will be made in 2012 and 2013 in support of the *Cape*-Class Patrol Boat platform introduction into service scheduled for early 2013. Installation of the turrets will be managed by Austal's Henderson, Western Australia facility. Support services to the programme will be completed at L-3 WESCAM's authorised service centre in Cairns, Queensland.

L-3 WESCAM's MX-10 shipborne turrets will be used to conduct surveillance duties such as border incursions, illegal immigration, fishing, smuggling, and quarantine control. Like the air and ground variants of the MX-10, the shipborne system can incorporate up to six payloads. Infrared, colour and electron-multiplied imaging sensors can be combined with a laser rangefinder and illuminator for enhanced mission performance. Real-time image enhancement is accomplished simultaneously across all sensors, including haze penetration and imaging blending – both of which lead to improved target detection and recognition. Currently, WESCAM MX-10 systems are operational on air, ground and water platforms in 17 countries around the world.

TransAsia Airways orders 8 ATR 72-600s

At Farnborough, ATR announced a contract for 8 firm ATR 72-600s, plus an option for one additional ATR 72-600. The deal, including the option, is valued at over US$ 210 million. Deliveries of these new ATR -600s will start in 2014 and extend through 2017. With the purchase of these aircraft, TransAsia Airways will progressively replace their current fleet of 9 ATR 72-500s operating in their domestic network with the newest ATR -600 series aircraft developments. These ATR 72-600s will be configured with 72 seats and will be equipped with a new full glass cockpit, developed for ATR by Thales, featuring state-of the art technologies in the field of navigation. The aircraft will also be equipped with Giugiaro-designed new ATR -600 series 'Armonia' cabin.

The ATR-72-600 at Farnborough.

RSAF selects Goodrich DB-110 ARS

Goodrich Corporation has received a contract from the U.S. Air Force to provide its advanced DB-110 airborne reconnaissance system for the Royal Saudi Air Force F-15S Modernisation Programme. This Foreign Military Sale (FMS) contract calls for Goodrich to provide 10 dual-band reconnaissance pods from its Westford, Mass. facility and five fixed, transportable and mobile ground exploitation stations from its Malvern, UK facility. The programme also includes extensive training and logistics support. Saudi Arabia is the 10th country to select Goodrich's DB-110 system, which is a digital, real-time, tactical reconnaissance system capturing images day and night using electro-optical/infrared sensor technology. Images can then be transmitted in real-time to analysts on the ground as well as viewed on the cockpit video display, enabling the pilot to verify targets and re-task based on opportunities revealed during the mission.

Premiers of the Yak-130

Irkut Corporation showcased its Yak-130 combat trainer for the first time at Farnborough which took part in the daily flight demonstration programme. The corporation has put special emphasis in its perspective manufacturing plans on extension of the Yak-130's production. At the end of 2011, Irkut had finalised implementation of its first Yak-130 export contract and signed up for the supply of 55 aircraft to the Russian Air Force, which had acquired twelve trainers a few years ago and are operational at their training centres.

Despite increasing competition in the lead-in fighter trainer (LIFT) market, Alexei Fedorov, Irkut's President, is rather optimistic on the market potential of this aircraft. According to his forecast there is a market for 400 of these examples. He further outlined that the Yak-130 had actually set new standards in LIFT design and manufacturing. Irkut's top management has revealed that main goal for the Yak-130 is further development towards becoming a light combat aircraft. In the initial phase, the Yak-130 would be fitted with electro-optics, new radio systems and equipment for air-to-air refueling. Later, the delevopment of an onboard radar would begin.

For Indians, the absence of promoting the Tejas LCA in the world market is sobering indeed.

VSC

AAI Unmanned Aircraft Systems in contracts

AAI Unmanned Aircraft Systems, an operating unit of Textron Systems, announced the receipt of a $358 million award from the U.S. Army's Programme Manager– Unmanned Aircraft Systems for engineering support and system upgrades that will create a fleet of 45 upgraded RQ-7B Shadow Tactical Unmanned Aircraft Systems (TUAS). Deliveries of 43 systems for the Army and two for the Marine Corps are expected to begin in late 2013. The new RQ-7B Shadow aircraft builds on the same architecture that has proven highly successful on the current Shadow aircraft throughout nearly 750,000 flight hours. It is multi-mission equipped with an integrated payload for day and night imagery, as well as communications relay and laser target designation capabilities. The aircraft also applies the Army's interoperability profiles, while vastly increasing communications bandwidth and enabling digital data delivery.

A Shadow 2 UAV on display at the Textron Systems pavilion at Farnborough

Addition of the UGCS and UGDT to the RQ-7B Shadow system supports the US Army's vision for a universal unmanned aircraft systems operator, and streamlines the development of new mission sets including manned/unmanned teaming. "With common hardware, software, controls and user interfaces, the UGCS has been proven interoperable with the Army's Gray Eagle and Hunter assets, as well as the Shadow system," says Reid. "It also complies with unmanned aircraft systems interoperability recommendations including NATO Standardisation Agreement 4586. Based on our battle-proven One System command and control architecture, the UGCS is 'universal' in the most fundamental sense."

Twin Otter Series 400 sales expand into Chinese market

Following on the heels of a successful Singapore Air Show and South East Asia aircraft demonstration tour, the Viking Twin Otter Series 400 has now broken into the Chinese market with new customers added to the sales roster. The first Chinese company to sign on for the Series 400 Twin Otter nineteen passenger regional commuter is Meiya Air of Hainan Province, ordering five float equipped aircraft with deliveries commencing in 2013. Meiya plans to put the aircraft into service supporting their seaplane flightseeing, charter, and corporate aircraft operations based in Sanya and the surrounding Hainan region on the South China Sea. Adding to the growing sales list are repeat customers Zimex Aviation of Switzerland and Loch Ard Otters of Florida. Zimex Aviation was an integral product launch customer, and took delivery of the very first Series 400 Twin Otter two years ago at Farnborough 2010. Since delivery, the Swiss company has been operating the Series 400 Twin Otter on charter operations in Uganda, and are so impressed with the aircraft's performance that they have returned to Viking to purchase a second Series 400 aircraft to add to their fleet. Loch Ard Otters also returns to Viking to order four additional aircraft after delivery of their first three aircraft, making Loch Ard the largest non-military Twin Otter Series 400 customer to date and second only to the twelve aircraft order placed by the Peruvian Air Force.

MBDA launches its Spear

MBDA unveiled their Spear, a new, high precision surface attack weapon for fast combat aircraft at this year's Farnborough International Air Show. Spear is the solution being proposed by MBDA to meet the UK Ministry of Defence's (MoD) requirement for a network centric, low collateral damage, multi-target stand off strike weapon for multiple loadout in the internal carriage bay of its future fleet of F-35 Joint Strike Fighter aircraft. With a range out beyond 100 km and, high sub-sonic flight, the missile is capable of dealing with an extremely broad target set ranging from fast moving manoeuvring vehicles including main battle tanks (MBTs), hardened structures, air defence units and missile launchers to naval vessels.

A very compact missile measuring approximately 2m in length, it features a multi-mode seeker for operations during either day or night operations regardless of weather conditions, a multi-effects warhead and GPS/INS guidance with a data link so that target updates can be transmitted during the missile's flight. The missile's high precision will ensure that it is compliant with increasingly complex and demanding rules of engagement. A turbojet propulsion unit provides the high velocity necessary to strike time sensitive targets before they can inflict damage or take cover. Though not network dependent, the Spear will be compatible within an NEC (Network Enabled Capability) framework.

Rafael's ImiLite centre

In most digital imagery collection systems of today, the exploitation station is designated to operate with a specific sensor and hence raw data from this sensor alone is processed. As a result, most digital collection assets operate as standalone systems; valuable raw data is exploited only locally and is not available to interested clients outside the immediate operating cycle. To overcome this problem, Rafael Advanced Defense Systems Ltd. has developed a cost-effective multi-source, multi-task imagery intelligence system - ImiLite, which receives, exploits and processes multiple imagery sensors and data in a unified way, and disseminates relevant reports, products and materials over the network to authorised end users and clients.

More than one million hours for Raytheon's ATFLIR on Super Hornet

Raytheon's Advanced Targeting Forward Looking Infrared pod, which delivers electro-optical/infrared imagery and target detection range for air-to-air and air-to-ground mission support, has achieved more than 1 million hours of operational flight on the U.S. Navy F/A-18 Super Hornet. The media was briefed on this during Farnborough 2012. "This achievement is a testament to the unmatched accuracy and performance of ATFLIR," said Mark Sims, director of Strategy and Business Development for Intelligence, Surveillance and Reconnaissance Systems at Raytheon's Space and Airborne Systems business. "Raytheon will continue providing critical information to naval aviators and support to U.S. Navy mission effectiveness."

The U.S. Navy's targeting pod of record, ATFLIR has been fully integrated and flight-tested on all F/A-18 aircraft models. ATFLIR offers a common optical path and continuous auto-boresight technology that generates the most precise target coordinates available, allowing the warfighter to respond quickly to enemy threats.

"Surpassing 1 million flight hours is a significant milestone for the ATFLIR," said Capt. Frank Morley, U.S. Navy F/A-18 and EA-18G programme manager. "The ATFLIR has been and will continue to be a critical subsystem for the Hornet and Super Hornet in supporting warfighters on the ground and in overseas contingency operations."

"IRKUT MS-21 will capture 10% of narrowbody market"

Alexey Fedorov, President of Irkut Corporation, expressed confidence that the upcoming MS-21 airliner would capture 10% of the market for narrowbody aircraft despite strong competition in the sector from established manufacturers Airbus and Boeing. According to Mr. Federov, the MS-21 is already in its final design stage, and offers a 5-7% advantage in operating costs when compared to the A320neo and 737 MAX. He pointed to weight and aerodynamics as areas that will contribute to reduced fuel burn that competitors "will find hard to match."

On 9 July at the Farnborough International Air Show, Irkut signed a deal with French company Zodiac Aerospace to do the interiors of the 150 and 180 seat variants of the MS-21. Powerplant selections have also been made, with Pratt & Whitney's PW1400G geared turbofan and United Engine Company's (Aviadvigatel) PD-14 turbofan engines on offer. The design of the 212-seat variant is yet to be finalised, and no engine has been selected for it either, according to Mr. Fedorov.

The MS-21 has received 185 confirmed

MS-21 mockup at the show

orders, while further options, MoUs and conditional orders take the order book to 250. Presently, the orders are primarily from Russian customers, but Fedorov states that "about 50 orders have come from outside Russia". Irkut also aims to have a network in place for aftermarket customer support by the time the aircraft has its first flight in 2015. Feorov was keen to point out that the MS-21 project was global, rather than only Russian. Indeed, key areas such as the engines, cabin interiors and avionics are handled by non-Russian suppliers.

Irkut would need to sell approximately 250 aircraft to break even on the programme. But with the Russian manufacturer predicting a huge market for narrowbody airliners in the future, sales of the MS-21 over the next two decades are forecast at around 1,200 units. Reflecting on these numbers, Fedorov stated that this "is a new era for Russian civil aerospace" and that Irkut is "in a good place with the MS-21."

SELEX Galileo celebrates 60 years of fire control radar

SELEX Galileo, marked 60 years involvement in airborne fire control radar with a unique celebration event in London and the publication of a handsomely illustrated book. Paying tribute to its rich UK-Italian heritage in air-to-air and air-to-surface radar technology, the company exhibited 17 radar sets, ranging from the AI.23 system equipping the RAF's Lightning fighter to its latest solid, state active electronic scanning array (AESA) products, at a reception to launch *Looking Forward: 60 Years of Fire Control Radar*.

"I am honoured to be here today representing years of outstanding individual, industrial and technological excellence. Stated Fabrizio Giulianini, CEO of SELEX Galileo. For many years armed forces around the world have relied on our radar to support airborne missions and come home safe. The United Kingdom and Italy have looked at SELEX Galileo, and all its previous incarnations, as the trusted partner to deliver the capability edge to counter enemies and threats."

Rafale Transformation Squadron with Thales simulators

Thales announced acceptance by the French defence procurement agency (DGA) of an upgrade to the F3.2 standard of the first two Rafale simulator cabins at the simulation centre in Saint-Dizier. The Rafale Transformation Squadron in Saint-Dizier, which has a total of four cabins, provides training on the Rafale for French Air Force and Navy pilots, offering them a very high level of training in a complex tactical environment. This upgrade will improve the instruction and training provided to prepare this squadron for missions of the Rafale F3 including: air-to-sea attack with the AM39 anti-ship missile, reconnaissance with the Reco-NG pod, air support with the Damocles laser targeting pod and nuclear deterrence with the ASMP/A enhanced medium-range air-to-ground missile. The Rafale simulation centre in Landivisiau, which has two simulators, will be upgraded to the F3.2 standard in the summer of 2013.

Focus for Indians at Farnborough 2012

Its Sharklets clearly seen, the A320neo in between sharp showers.

The monsoons obviously followed Indians to Farnborough, with downpours periodically sending visitors to shelter under aircraft wings at the static displays or ducking into chalets to more comfortably wait out the rain.

Indian official presence was focused on HAL's double-storied Chalet, located at the far end and visited by executives specially invited for meetings with HAL's Chairman and his Directors. The chalet itself was somewhat spartan with only two aircraft models displayed, the IJT and LCH but there was no media briefing nor presentations this time around. In fact, any foreign interest generated in showcasing the HAL Dhruv ALH first at Berlin Air Show (2008) and then Farnborough the

HAL's Chalet at row K-8/9

HAL models inside the Chalet

same year, has sadly not been followed up, even though some ALHs were exported to Equador and there is latent interest on this very versatile rotorcraft in many parts of the world, including Europe for special purposes.

There was very little presence from the Indian armed forces: a lone Air Marshal of the Indian Air Force, no officer from Naval Air or Coast Guard although the ADG Army Aviation was present. The Indian Air Force would have greatly benefited from observing how two particular programmes are proceeding at fast pace, having earlier been 'rejected' by the IAF owing to insufficient awareness or analyses: the MMRCA and BTA.

First the MMRCA : of the six original contenders only three aircraft types were present at Farnborough and displaying their attributes on the ground and in flying displays : the Typhoon, Gripen and Super Hornet. There were no Russian fighters, nor Chinese and India's M-MRCA choice, the Rafale was also absent, but then the French have rarely brought fighters to Farnborough–only business jets !

Perhaps the most important event at Farnborough 2012 in this context was official unveiling of the ES-O5 Raven AESA radar installed on the Gripen NG fighter. Saab and Selex have steadfastly worked on this system and the new generation fighter, ordered by

Eddy De La Motte of Saab with Bob Mason of Selex Galileo after the ES-05 Raven AESA radar was unveiled on the Gripen NG.

Switzerland and Sweden (over 100 aircraft) will surely take the market by storm as not only is this now a 'virtual 5th Generation' fighter, it is by far the most affordable and cost-effective. In fact, independent analysts have calculated that the Gripen E (the new designation) will not only cost less than half that of contemporary fighters, but its life-cycle cost is less than one-third which was ostensibly the key reason for selecting the IAF's MMRCA!

The Eurofighter marked the start of each day's flying display with its thunderous take off and its power plant, the Eurojet EJ-200 was on display outside the BAE *Hall of Innovation*.

Then the BTA : after a quick evaluation, the IAF's choice was dependent on 'L-1' and the Pilatus PC-7 Mk.II selected. At that time, the Grob 120TP did not have a certified ejection seat and thereby lost out. Well, Martin Baker has now certified its light weight Mk.17 for the Grob 120TP which is fast becoming the basic trainer of choice of the world, with some half-dozen Air Forces having ordered it, including Indonesia, Argentina, Kenya, Brazil and possibly UAE. Again, the Grob 120TP costs less than half that of the selected type !

The Russians were very active, but primarily promoting their new civil jetliners, as also the impressive Yak-130 advanced jet trainer and light attack aircraft, which is being vigorously promoted to Air Forces looking for affordable combat aircraft, a market where the Indian Tejas light combat aircraft could well take a major share once, and whenever, the Government of India, ADA/HAL get their act together !

Other aeroplanes of direct interest to Indians at the Show included the Airbus A320neo, with its dramatic sharklets. 180 of these are being ordered by IndiGo who have selected the efficient PW 1000G engine to power this airliner. The giant A380, in colours of Malaysia Airlines had its majestic presence accentuated by its silent and awesome flying display, and was seen taxiing past the RUAG Dornier 228NG, whose major structural assemblies and wings are provided by HAL's Kanpur Division.

Hartmut Tenter, CEO of Eurojet with the EJ-200 engine

The Martin Baker Mk.17 light weight ejection seat which is now standard on the Grob 120TP.

A380 taxis past Dornier 228NG

The Boeing C-17 Globemaster III was of pertinent interest, with the first such aircraft now being assembled for the Indian Air force at Long Beach California. At the other end of the special mission aircraft spectrum was the Saab 340 MSA, with Telephonics RDR-1700B maritime surveillance radar on prominent display.

The *Vayu* team was all over the Show as readers will ascertain while latest copies of the Journal were snapped up at the *Aviation Bookshop* under the watchful eye of Simon Watson.

The Vayu Team


The Telephonics RDR-1700B maritime surveillance radar mounted under the Saab 340 MSA

Crew entrance into the Boeing C-17 Globemaster III

Showing the Flag–Simon Watson at his tent, next to the Virgin Galactic display.

Future British Helicopter Strategy

The British Ministry of Defence's *Defence Rotary* Wing *Capability Study* has opined that its future rotary wing capability will be identifiable by four essential types: the Chinook, Wildcat (development of the Lynx), Merlin and Apache.

Pair of AgustaWestland Lynx of the Royal Navy and British Army. The Lynx has been further developed as the AW159 Wildcat.

In addition, it is confirmed that the RAF's Merlin HC2 fleet will be transferred to the Royal Navy's Commando Helicopter Force. Also, the phase out of Sea Kings will be by 2016 and the transfer of search and rescue to a civilian contractor to be run by the Department for Transport.

Mi-17V5s for Afghanistan Air Force

The US Department of Defence will purchase ten additional Kazan-built Mi-17V5 helicopters for operations by the Afghan Air Force, as confirmed by Russia's state-run arms export agency, Rosoboronexport. The Pentagon had previously ordered 21 Mi-17V5s for Afghanistan in a May 2011 US Army contract, worth $375 million, which also included options on a further 12 helicopters. Two of these options were exercised under a protocol signed in February 2012 and the latest contract will confirm orders for the balance 10 helicopters.

F-35s for USAF and USMC

With the delivery of four Lockheed Martin F-35 Lightning II aircraft in end-June 2012, an important milestone was achieved as the Department of Defence now possesses more operational-coded F-35s than test aircraft. A total of nine F-35s have been delivered for the year 2012, giving the DoD a total of 30 aircraft, of which 16 are operational and 14 are test aircraft.

The four aircraft, which were formally accepted by the Defence Contract Management Agency with the signing of Department of Defence Form 250 (DD-250), are the first jets manufactured as part of Low Rate Initial Production (LRIP) Lot 3. They will begin ferrying to Eglin Air Force Base, bringing the total to 16.

Swiss pilots test fly Gripen NG

Test pilots and flight test engineers from the Swiss Air Force and the Swiss federal defence procurement agency, *Armasuisse*, have visited Saab in Linköping, Sweden, to carry out test flights with the Gripen NG test aircraft, which will evolve into the new generation E/F.

On 30 November 2011, Switzerland selected the Gripen E/F as the preferred candidate to replace the Swiss Air Force's ageing fleet of Northrop F-5E/F Tigers. The Swiss Department of Defence, Civil Protection and Sports (DDPS) was commissioned

Lt Col Fabio Antognini, Test Pilot Swiss Air Force flies the Gripen NG together with Saab's Chief Test Pilot, Richard Ljungberg.

to start discussions with Saab and the Swedish Government to optimise Saab's offer. The negotiations have continued according to plan and the test flights in Sweden were part of the on-going process.

The three day programme, conducted between 2-4 May, included simulator training and four test flights, focused on air defence and air policing mission profiles with different weapon configurations, which included IRIS-T as well as both the Meteor and AMRAAM.

30 Ansat helicopters for Russian Air Force

Over 30 Kazan Ansat helicopters are to be delivered to the Russian Air Force by 2020 for training purposes. The Syzransky Flight Training School at Sokol will receive six Ansat-Us in 2012 and over 30 by 2020. This Flight Training School is in the process of converting to the Ansat and has initiated instructor training. The new helicopter is replacing the veteran Mil Mi-2 as a utility and training helicopter. The version can also be configured with varying levels of control difficulty for training to allow practice of engine failures.

German Eurofighter Typhoons in 'Red Flag – Alaska 2012'

Eight Eurofighter Typhoon aircraft from German Air Force's *Jagdgeschwader* 74 (JG 74) participated in a two week 'Red Flag' exercise in Alaska alongside American, Polish, Japanese and Australian air forces. Eurofighter Typhoons were deployed from their home base in Neuburg in southern Germany, to Eielson Air Force Base.

This edition of the Red Flag (11-22 June 2012) provided "an opportunity for the participating nations to gain invaluable experience in tactical missions, collective defence and conflict management." Fighter Wing JG 74 took part in the exercise in readiness for its assignment to the NATO reaction force this year, assuring the unit has the right level of interoperability and capabilities for such a role.

During the two-week employment phase of the exercise, the JG 74 Typhoons flew 98 of the planned 102 sorties. Aircrews were subjected to every conceivable combat threat. Scenarios were shaped to meet each exercise's specific training objectives. Typically about 70-90 fighters were airborne at the same time in one of the two daily waves. The exercise had a building block approach, where mission difficulty increased to a point where up to about eighteen threat aircraft presented a highly capable, modern opponent.

First AW101 delivered to Turkmenistan

The first of two AgustaWestland AW101 Srs 643s has been delivered to the Turkmenistan Government. The helicopter,

which had first flown on 7 March 2012, was airfreighted to Turkmenistan in an Antonov An-124.

Both aircraft have been ordered for VVIP transport under a contract finalised in the third quarter of 2010. The deal also includes five AW139s for transportation of government officials.

CAE to develop C-130J simulators

Lockheed Martin Corporation has awarded CAE with contracts to design and manufacture four C-130J weapons systems trainers and a range of other C-130J training devices for the US Air Force. As part of the C-130J Maintenance and Aircrew Training System Phase II programme, prime contractor Lockheed Martin and CAE will design 16 training devices including weapons systems, enhanced integrated cockpit systems, loadmaster fuselage and loadmaster part-task trainers.

Su-30MK2s delivered to Uganda

According to Russian sources, the contract for six Sukhoi Su-30MK2 multi-role fighters to the Uganda Peoples' Defence Force (UPDF) has been completed with delivery of the final two aircraft to Entebbe. The aircraft were delivered in three batches, two aircraft at a time, the first pair in mid-2011 on board an An-124.

Egyptian F-16D Block 52s

The first of four two-seat F-16Ds on order for the Egyptian Air Force flew on 16 May 2012 from Fort Worth, Texas. The EAF has ordered 16 single-seat F-16C Block 52s, the first of which made its maiden flight on 6 April. These aircraft were ordered under a government-to-government agreement signed on 23 December 2009.

Philippine Air Force "interested" in KAI TA.50s

The Philippine Air Force has shortlisted the KAI TA-50 light attack version of the T-50 Golden Eagle as its option to meet its requirement for 12 new lead-in fighter trainers, "subject to approval". It was earlier indicated that the Philippine Air Force was acquiring second-hand F-16C/Ds from the USA and the Aermacchi M-346 had also been a contender. The order could be placed soon to ensure first deliveries in either late 2013 or early

2014, with total cost of purchase estimated at $590 million. The type will be used both as a trainer and as a light attack aircraft. The TA-50 is capable of being armed with AIM-9 Sidewinder air-to-air missiles and AGM-65 Maverick air-to-surface weapons.

ITT Exelis to upgrade US Navy F/A-18s

ITT Exelis has been awarded a $238 million contract for the AN/ALQ-214 on-board jammer system on F/A-18 aircraft. This system (AN/ALQ-214 (v) 4/5) is smaller and lighter than its predecessor and can be installed on both the legacy Hornet (F/A-18 C/D) and Super Hornet (F/A-18 E/F) variants. Under this contract, Exelis will provide 104 systems through fiscal year 2016. The AN/ALQ-214 Radio Frequency Countermeasures (RFCM) system combines sensitive receivers and active countermeasures to electronically shield Navy fighters from radio frequency (RF) guided threats. It is part of the Integrated Defensive Electronic Countermeasures (IDECM) system, which is the next-generation self-defence system for the US Navy's F/A-18.

BAE Systems to enhance Saudi training capability

Following an agreement between Saudi Arabia and the United Kingdom, under the *Saudi British Defence Co-operation Programme*, BAE Systems has been awarded a contract for £1.6bn (equivalent) to support the future aircrew training requirements of the Royal Saudi Air Force.

The contract covers the provision of equipment and training devices including aircraft simulators, training aids and aircraft on which to train aircrew. Included within this requirement is the supply of 55 Pilatus PC-21 aircraft to fulfill the basic training role and 22 BAE Systems Hawk Advanced Jet Trainer aircraft, to fulfill the fast jet training part of the syllabus. In addition the Company will provide an initial support package including the provision of spares, technical publications and post design support. Deliveries of the Pilatus PC-21, manufactured in Switzerland, will commence in 2014, while the Hawks will be delivered from 2016.

Rolls-Royce M250 engines for Grob G120TP trainer

Rolls-Royce has delivered the first two production M250 engines to Grob for its new G120TP trainer aircraft and is on course to deliver another 12 engines by the end of 2012. The G120TP high-performance, fixed-wing trainer is powered by a single M250-B17F turboprop engine, which provides 450 shp and enables the aircraft to fly at 280 mph and reach up to 6 g.

André Hiebeler, Grob's Chief Sales Officer & Company CEO, said, "We are very excited to see the first G120TP aircraft roll off our production line, powered by M250 engines from Rolls-Royce. The M250 provides the power that makes the G120TP 'best in class' among its competitors and we look forward to a long working relationship with Rolls-Royce in future."

C-17 for UAE Air Force and Air Defence

Boeing has delivered a fifth C-17 Globemaster III airlifter to the United Arab Emirates (UAE) Air Force and Air Defence. The UAE had accepted delivery of four C-17s in 2011 and has one more airlifter on order for delivery later in 2012.

The UAE is Boeing's sixth international C-17 customer and received its first airlifter in May 2011. Since that time, the UAE Air Force and Air Defence C-17 fleet have amassed more than 2,000 flight hours and carried more than 3,000 passengers and nearly 4 million pounds of cargo.

Final Wedgetail AEW&C aircraft for Australia

The Boeing Company has delivered the sixth and final Wedgetail Airborne Early Warning and Control (AEW&C) aircraft to the Royal Australian Air Force (RAAF), as also all ground segments to support the fleet, which is based at RAAF Base Williamtown in Newcastle, Australia.

Based on the Boeing Next-Generation 737-700 commercial airliner the 737 AEW&C aircraft is designed to provide airborne battle management capability with an advanced multirole electronically scanned radar and 10 state-of-the-art mission crew consoles that are able to track airborne and maitime targets simultaneously. The mission crew can direct offensive and defensive forces while maintaining continuous surveillance of the operational area.

Boeing also has delivered three 'Peace Eye' AEW&C aircraft to the Republic of Korea, with one more scheduled for delivery later this year. Turkey's first 'Peace Eagle' AEW&C is on plan for delivery by the end of 2012.

Boeing Phantom Eye autonomous flight

Boeing's Phantom Eye unmanned airborne system (UAS) made its first autonomous flight on 1 June 2012 at NASA's Dryden Flight Research Centre at Edwards Air Force Base. Phantom Eye is the latest in a series of Boeing-funded rapid prototyping programmes, which include Phantom Ray, Echo Ranger, ScanEagle Compressed Carriage, and an associated Common Open Mission Management Command and Control (COMC2) system capable of managing all of the company's unmanned assets. The flight took place following a series of taxi tests in April that validated ground guidance, navigation and control, mission planning, pilot interface and operational procedures.

Elbit Systems to upgrade ROKAF C-130s

Elbit Systems Ltd. has been awarded a contract valued at $62 million to upgrade the Korean Air Force C-130 transport aircraft. Under the contract, the C-130 aircraft will be installed with various types of advanced electronic systems. In addition, Elbit Systems will convert the existing analog cockpit to a 'Glass-Cockpit' using Elbit Systems' cutting-edge digital flight displays. The project, to be performed over four years, will be executed in cooperation with Korea Aerospace Industries Ltd. (KAI), who is the leading local aircraft manufacturer in Korea.

Sagem Patroller in multi-mission configuration tests

Sagem has successfully completed a new series of test flights of its long-endurance Patroller drone system, in a multi-sensor, multi-mission configuration. Patroller is a 1-ton class drone, based on an aircraft certified by the European Aviation Safety Agency (EASA), incorporating technologies developed by Sagem for the Sperwer Mk II tactical drone system, and its operational experience in Afghanistan. The modular design of Patroller enables it to be fitted with pod-mounted payloads for flights lasting from 20 to more than 30 hours, at a maximum altitude of 25,000 ft. Offering "reasonable" operating costs, it meets requirements for long-endurance surveillance for defence and homeland security forces, as well as inter-ministerial missions.

Saab's Skeldar demonstrated

A unique live demonstration to display the integration between Skeldar and 9LAND BMS took place at the Swedish Armed Forces Ground Combat Days in southern Sweden, where Skeldar flew a mission to deliver tactical information trough the 9LAND BMS to troops engaged in a combat mission.

The ability to be rapidly tasked and dynamically re-tasked during flight is one of the key capabilities in the concept of operation (CONOPS) for the Skeldar UAS. This ability depends not only on Skeldar's VTOL capabilities, but also on the capability to deliver near real-time information and visualisation of the battle space, thereby adding a link in the sensor-to-shooter loop. Saab has integrated the Skeldar UAS with a Battle Management System (BMS) enabling the exchange of target data and other tactical information, which exchange allows all units using the BMS to use information from the Skeldar UAS.

Alliance between Oto Melara and Diehl Defence

Oto Melara and Diehl Defence entered into a Cooperation Agreement, during the EUROSATORY 2012, signed by Dr. Carlo Alberto Iardella, CEO of Oto Melara and Claus Guenther, CEO of Diehl Defence. The strategic alliance focuses on collaboration in the field of large calibre conventional and guided ammunition for navies and armies. Oto Melara and Diehl are already carrying out strong synergies based on national programmes: Germany with the 120mm Guided Mortar Munition and 155mm Guided Artillery Munition and Italy with the Guided Long Range and Ballistic Extended Range ammunition VULCANO 127mm/155mm.

NGC unveils US Navy's first unmanned aircraft

Northrop Grumman Corporation have unveiled the first US Navy MQ-4C Triton Broad Area Maritime Surveillance Unmanned Aircraft System (BAMS UAS) in a ceremony at their Palmdale, Calif., manufacturing facility. "Northrop Grumman is proud to provide the US Navy with the MQ-4C Triton unmanned aircraft, a key element of the BAMS UAS programme, representing the future of naval aviation and a strategic element of the US Navy," said Duke Dufresne, Northrop Grumman

Aerospace Systems sector vice president and general manager for unmanned systems.

The Northrop Grumman BAMS UAS is a versatile maritime intelligence, surveillance and reconnaissance system to support a variety of missions while operating independently or in direct collaboration with fleet assets. When operational, BAMS will play a key role in providing commanders with a persistent, reliable picture of surface threats, covering vast areas of open ocean and littoral regions as the unmanned segment of the Navy's Maritime Patrol Reconnaissance Force.

Norway and USA in joint integration of JSM on F-35

Norway and USA are to collaborate on integration of the Joint Strike Missile (JSM) on the F-35 JSF. Defence Minister Espen Barth Eide announced that the Norwegian Government will start the process to finalise the development of JSM and integration on the F-35, the decision coming as a consequence of Secretary of Defence Leon Panetta's confirmation of US support for integration.

Through the development of the Naval Strike Missile (NSM), the Norwegian Armed Forces has established Kongsberg and other Norwegian industries as suppliers of long-range, precision strike missiles that will meet military requirements in a 20 to 30-year perspective.

NGC fire control radars for Thailand, Iraq and Omani F-16s

Northrop Grumman Corporation has received an $87.8 million foreign military sales (FMS) contract to provide the APG-68(V)9 airborne fire control radar to Thailand, Iraq and Oman for operation on the F-16 fighter aircraft. The company will deliver six radar systems to the Royal Thai Air Force, 22 radar systems to the Iraqi air force and 15 radar systems to the Royal Air Force of Oman, for a total of 43 systems. Deliveries are expected to be completed by March 2015. The FMS contract is managed by the Aeronautical Systems Centre, Wright-Patterson Air Force Base, Ohio.

Litening G4 Targeting Systems for Royal Danish Air Force

The Danish Ministry of Defence has selected Northrop Grumman's Litening G4 targeting system for its F-16 fighter aircraft. Under the terms of the contract with the Danish Defence Acquisition and Logistics Organisation, Northrop Grumman will supply Litening G4 pods, data links, spares, support equipment, training and associated logistics support to the Royal Danish Air Force. Deliveries will begin in August 2013.

NATO AGS contracts with Cassidian

Cassidian, the defence and security company of EADS, brings its expertise in intelligence, surveillance and reconnaissance (ISR), data exploitation and secure data links into NATO's Alliance Ground Surveillance (AGS) programme. NATO completed the signing of a contract with Northrop Grumman on 20 May 2012 at the NATO Summit in Chicago, as prime contractor, to provide the AGS Core System including air and ground segment.

EADS Deutschland GmbH, operating through Cassidian, the defence and security division of EADS will supply the Mobile Ground Segment (MGS) entities in close cooperation with subcontracted companies in six other AGS participating nations including CzechRepublic, Estonia, Latvia,Lithuania, Slovenia and Slovakia. Cassidian's MGS is the mobile part of the AGS Core Ground Segment responsible for the exploitation of reconnaissance sensor data and further distribution within NATO's command structure.

MBDA's Meteor firings conclude with lethal display

MBDA's Meteor Beyond Visual Range Air to Air Missile (BVRAAM) concluded its guided firing programme with three direct hits from three firings during Government-sponsored Electronic Protection Measure (EPM) trials against targets deploying countermeasures. The comprehensive development

New generation weaponry integrated in new generation Gripen : Meteors at Farnborough 2012.

and Government trials programme involved a total of 21 air launched firings, providing evidence of a progressive maturity. "As a result, MBDA is on track to complete qualification and make the first production deliveries of this unrivalled capability by the year end."

The firing programme was carried out in two main phases with development firings in 2006 -2008 followed by a Guided Firing campaign from 2009-2012. The Guided Firings and EPM were from Gripen and Tornado F3 against a variety of scenarios and were undertaken at ranges in the United Kingdom and Sweden.

Airbus Military C295 with Marte Mk2/S anti-ship missile

Airbus Military and MBDA have flown the C295 maritime patrol aircraft with an instrumented Marte MK2/S anti-ship (inert) missile installed under the wing. The flight was the first of a series of trials planned in a joint Airbus Military – MBDA collaboration to validate the aerodynamic integration of Marte on the C295. Subsequent flights will include handling qualities tests and aircraft flight performance tests.

The MBDA Marte MK2/S missile is a fire-and-forget, all-weather, medium-range sea-skimming anti-ship weapon system, equipped with inertial mid-course guidance and radar homing terminal guidance, and capable of destroying small vessels and heavily damaging major vessels. The missile has a weight of 310 kg and is 3.85 m long.

First A400M for Turkey

The Airbus Military A400M final assembly line (FAL) in Seville (Spain) initiated work on the first A400M for the Turkish Air Force. The integration of the wings and central wing-box for this aircraft, known as MSN9, began in mid-May 2012, while the integration of the nose and the fuselage started by the end of June. With the arrival of the vertical tailplane (VTP) and the horizontal tailplane (HTP), all the components for this

third serial production A400M are already being integrated in the FAL. Turkey will take delivery of its first A400M military airlifter in 2013.

The photograph shows the nose and fuselage join up process underway.

ITT Exelis contracts for F/A-18 EW system software upgrade

ITT Exelis has been awarded a $19.6 million contract for software enhancements to the F/A-18 Integrated Defensive Electronic Countermeasures (IDECM) ALQ-214 Common On-board Jammer (OBJ). The software upgrade will be incorporated into the IDECM ALQ-214(v)4/5 Common OBJ systems that are installed on US Navy F/A-18C/D/E/F aircraft. This upgrade will enable faster recognition and response times, and introduce new Digital RF Memory based jamming techniques. This software upgrade will ensure that IDECM Common OBJ equipped aircraft can perform and survive their missions in the face of current and projected threats.

Thales TopOwl helmet mounted sight and display selected for A400M flight tests

Thales announced that its TopOwl HMSD (Helmet-Mounted Sight and Display) has been selected by the *Organisation for Joint Armaments Cooperation* (OCCAR) for flight testing on board the A400M prototype. The purpose of the tests, scheduled between June 2012 and April 2013, is to confirm compatibility of HMSD with the military transport aircraft for night missions. During the campaign, A400M pilots will benefit from the integrated night vision function of the TopOwl. With more than 1,000 systems delivered to date, TopOwl has already been selected for numerous combat helicopters and has already shown its efficiency in deep-night missions conducted by combat helicopters in Libya and Afghanistan.

Upgradation of RAF Tranche 1 Typhoons

On 21 June 2012, BAE Systems furnished detailed upgrades to RAF Tranche 1 Eurofighter Typhoons. *A Capability Sustainment Team* within the company developed a first Tranche 1 upgrade, 'Drop 1' already incorporated, while a second upgrade package, 'Drop 2', is entering service with the RAF to provide capability updates to Typhoon's avionic systems and deliver availability and sustainability improvements.

NATO Eurofighter and Tornado Management Agency (NETMA) has stated that "This is how we will work as a delivery team on Contract 1, the engineering services contract that is the first tangible delivery of a joint transformation programme between industry and NETMA. Contracts 1 and 4 were signed in March 2012."

Saab's special mission solutions

Saab has recently unveiled its 340 Maritime Security Aircraft (MSA) and the company plans to market both the Saab 340 and Saab 2000 in the special mission role. The Saab 2000 Erieye airborne early warning and control (AEW&C) platform is already established as is the Saab 340 MSA, but during the last one year, the marketing process for the Saab 2000MPA (*Swordfish*), which is aimed for various navies, has begun along side the Saab 2000 Airtourer.

Saab's Head of Special Mission Aircraft Programmes Joakim Mevius said, "we see a market for between 50 and 100 special mission aircraft over the next ten years and the Saab 340 is an ideal platform to keep lifecycle costs down."

Saab is refurbishing Saab 340 airframes to allow the platforms to continue for the next three to four decades. With experience in special mission aircraft in countries as diverse as Brazil, Greece, Japan, Mexico, Pakistan and Sweden, Saab is convinced that the new MSA is optimally positioned to fulfill requirements of diverse customers at an affordable price of $20 million. The platform has been optimised for general surveillance, detection and classification of maritime activity; inspection of fisheries and management; search and rescue; counter-smuggling surveillance and illegal immigration.

Two more C-17As ordered

Boeing has been awarded two separate contracts by the US Air Force, each for procurement of additional C-17A Globemaster IIIs. It is expected that the first of these is a production order for the Royal Australian Air Force's (RAAF's) sixth C-17A. The second is a for one C-17A replacement aircraft for the US Air Force, with work on the aircraft due to be completed by May 2013. This aircraft was funded in the Fiscal Year 2012 US defence budget and will be an attrition replacement for the C-17A, which was lost in a crash in Alaska 2010.

F-35 Lot VII Production

Lockheed Martin has been awarded an advance acquisition contract by US Naval Air Systems Command to provide long lead-time parts and components required for delivery of 35 low-rate initial production (LRIP) Lot VII F-35 Lightning II Joint Strike Fighters. This includes parts for 19 F-35A conventional take-off

and landing (CTOL) aircraft for the US Air Force; three CTOL F-35As for the Italian Government; two CTOL F-35As for the Turkish Government; six short take-off/vertical landing (STOVL) F-35B aircraft for the US Marine Corps; one STOVL F-35B for the UK and four carrier variant F-35Cs for the US Navy.

Saudi order for PC-21s

As earlier reported, the Royal Saudi Air Force (RSAF) has signed a contract with BAE Systems to supply 55 Pilatus PC-21s for the RSAF, which is possibly the biggest contract ever in history of the Swiss manufacturer, apart from the order for

earlier generation 75 PC-7 Mk.IIs ordered by the Indian Air Force. Deliveries of the PC-21s ground-based training systems and support packages are scheduled to commence in 2014. The aircraft will provide basic flying training instruction at the Riyadh King Khaled Air Base, replacing the RSAF's current Pilatus PC-9s, operated at the Academy by Nos. 9 and 22 Squadrons.

FMV agreement on Saab Gripen

Saab has received formal orders from the Swedish Defence Materiel Administration (FMV) for Gripen development, support and maintenance through 2016. The orders entails an initial order of SEK 3.6 billion plus options for additional orders amounting to a maximum of SEK 2 billion until December 2016.

The agreement comprises several parts, including performance-based support and maintenance solution, performance-based logistics as well associated ground resources for upkeep. The above would entail that Saab provides guaranteed service times for systems and subsystems that are included in Gripen. Activities included in the contract are, for example, supplying the Swedish Armed Forces with spare parts, maintenance of aircraft systems, technical engineering support, technical publications and logistics solutions for operation of the Gripen system in Sweden, the Czech Republic, Hungary and Thailand.

Meanwhile, Saab has received an order from the FMV for maintenance of the Erieye airborne radar system (Airborne Surveillance and Control, ASC890). Work will take place between 2012 and 2014. Erieye is mainly developed and produced by Saab in Gothenburg, but work will also be undertaken at other sites.

Raytheon's JLENS and Patriot in intercept test

Two Raytheon Company systems, the Joint Land Attack Cruise Missile Defence Elevated Netted Sensor System (JLENS) and the Patriot Air and Missile Defence System, demonstrated their ability to work together to detect, track and shoot down a test target simulating a hostile cruise missile during a recent exercise at the Utah Training and Test Range. This test reinforces the ability of Raytheon systems to integrate in support of a comprehensive air and missile defence strategy involving multiple sensors and interceptors. In addition to destroying the target drone, initial indications are that the JLENS-Patriot systems integration met test objectives. The JLENS surveillance system was evaluated on its capabilities to detect and track a long-range

threat and then cue the fire control radar. In turn, the fire control system was evaluated on its ability to track and transmit target data to Patriot computers. All data from the exercise will be analysed closely against test parameters.

Northrop Grumman in Naval Air Systems Command Contract

Northrop Grumman has won a contract from the Naval Air Systems Command to deliver Litening G4 targeting systems, under terms of which Northrop Grumman will supply the US Marine Corps with Litening G4 pods and G4 upgrade kits and spares to the Air National Guard to bring their Block 1 pods to the G4 configuration. Northrop Grumman has delivered more than 200 Litening G4 systems to date, which is newest addition to the company's Litening family of targeting pods, delivering the latest advancements in sensor, laser imaging and data link technology.

Flight trials for Saab RIGS Head-Up Display system

Saab's innovative integrated Head Up Display (HUD) System 'RIGS' has completed initial flight trials in Sweden and has been integrated with Garmin's G500H Avionic System and Maxviz' EVS-1500 sensor in an AS350 helicopter. The successful flight trials have included symbology evaluations, overlay of images from the Enhanced Vision Sensor (EVS) and Synthetic Vision depictions on the HUD.

RIGS is an advanced, light-weight integrated HUD, that improves safety during all phases of flight. With its high resolution and excellent optical quality, the HUD provides crisp and clear flight information enabling head-up/eyes-out operations, significantly enhancing situational awareness and flight safety. Saab is developing the HUD System with the capability and integrity to ensure compatibility with current and future Enhanced Flight Vision System (EFVS) operations.

Elbit Systems' Unmanned Aircraft Systems (UAS)

Elbit Systems Ltd. has been awarded a $160 million contract by "a European customer" to supply Unmanned Aircraft Systems (UAS) over the next two years. Joseph Ackerman, President and CEO of Elbit Systems remarked, "More and more customers worldwide have come to the conclusion that Elbit Systems' UAS are the ultimate solution for their operational needs, following years of extensive operational experience accumulated in service with the Israeli Defence Forces (IDF), as well as additional world leading armed forces for their Air, Land and Special Forces."

Airbus assembly line in USA

Airbus will establish a manufacturing facility in the United States to assemble and deliver A320 Family aircraft. This will be located at the Brookley Aeroplex in Mobile, Alabama and will be the company's first US-based production facility. Airbus has stressed that the assembly line, which will "create jobs and strengthen the aerospace industry" is part of its strategy to enhance Airbus' global competitiveness by meeting the growing needs of its customers in the United States and elsewhere.

The facility in Alabama will assemble the single-aisle family of A319, A320 and A321 aircraft with construction of the assembly line to begin in summer 2013. Aircraft assembly itself is planned to begin in 2015, with first deliveries from the Mobile facility beginning in 2016, with an anticipated production of 40-50 aircraft per year by 2018.

Garuda Indonesia orders 11 more A330s

Garuda Indonesia has placed an order for 11 more Airbus A330-300 widebody aircraft, the third to be placed by Garuda Indonesia for the A330 since July 2010, with the carrier now having a total of 21 aircraft on firm order for future delivery. All the aircraft will be powered by Rolls-Royce Trent 700 engines. Garuda Indonesia has chosen the latest extended range

235 tonne maximum take-off weight variant of the A330-300. The carrier will operate the aircraft with a premium two class layout on services from its hubs in Jakarta and Denpasar (Bali) to destinations in Asia, the Middle East and the Pacific. Garuda Indonesia currently operates 14 A330 aircraft, comprising eight A330-200s and six A330-300s.

Rolls-Royce Trent 1000 milestone

Rolls-Royce has successfully completed the first run of an upgraded version of the Trent 1000 that will be the launch engine for the latest member of the Boeing 787 Dreamliner family, the 787-9. The Trent 1000 Package C programme will provide 74,000lb thrust for the 787-9 Dreamliner aircraft, which is due to enter service with Air New Zealand in 2014. Trent 1000 Package C engines will also begin powering 787-8 aircraft that enter service later in 2014.

Two Trent 1000 Package C engines are now being built for initial flight testing on the Rolls-Royce 747-200 flying test bed, with a three-month programme scheduled to begin in the summer which will optimise a new advanced turbine case cooling system to improve efficiency.

Lufthansa's B747-8 equipped with Recaro seats

On 2 May 2012, Lufthansa took delivery of its first Boeing B747-8 Intercontinental aircraft in Frankfurt, having on board economy class seats from Recaro Aircraft Seating. The aircraft seat supplier is providing more than 5,000 *Comfort Line* 3520 seats to equip Lufthansa's new B747-8 Intercontinental aircraft, as well as additional 5,000 seats for retrofitting its existing B747-400 fleet. The Recaro *Comfort Line* 3520 seats will be installed in a total of 20 Lufthansa B747-8 Intercontinentals. Specially designed to meet the airline's requirements, this seat model offers passengers a high degree of comfort on long-haul flights. In addition, Recaro Aircraft Seating is equipping 19 B747-400 aircraft in the current Lufthansa fleet with the same seat type. Overall, Germany's flagship carrier has ordered more than 10,000 seats to equip the new arrivals and to retrofit existing ones. Deliveries of the seats began in 2010.

Meanwhile, Recaro Aircraft Seating sales revenues reached a record 304.3 million Euros in 2011, representing a growth of about six percent over the previous year. The company also set a new record for the number of units delivered. In the past year, Recaro Aircraft Seating produced more than 85,500 seats at its three worldwide production sites.

Qantas selects LEAP-1A engines for A320neos

The Qantas Group has selected CFM International's advanced LEAP-1A engine to power 78 Airbus A320neo aircraft currently on order. The engine order is valued at $2 billion including spare engines. This takes the total LEAP orders and commitments to more than 3,500 engines. In addition to the

LEAP-1A being an option on the Airbus A320neo, the LEAP-1B and LEAP-1C are exclusive powerplants for the Boeing 737 MAX and COMAC C919, respectively. The first aircraft are scheduled for delivery in 2016 and will support Jetstar, the low-fare subsidiary of the Qantas Group.

The foundation of the LEAP engine is based on advanced aerodynamics and materials technology development programmes. The engine is designed to provide 15 percent better fuel consumption and an equivalent reduction in carbon-dioxide emissions along with a 50 percent reduction in oxides of nitrogen emissions and up to a 75 percent reduction in the engine's noise footprint.

Snecma assembles first Silvercrest engine

On 14 May 2012, Snecma (Safran group) crossed a major milestone for its new-generation Silvercrest business jet engine by starting assembly of the first complete engine, in preparation for the first ground test. After initiating full scale engine development in the third quarter of 2010, Snecma has now completed the design phase, in line with its development schedule. All parts for the first test engine (FETT) are now ready or in production. This first complete Silvercrest engine is being assembled and will start ground tests during summer, followed by flight tests slated for the first half of 2013.

The new Silvercrest bizjet engine features innovative technologies drawn from Snecma's advanced research programmes and also incorporates feedback from the company's vast operating experience as engine supplier for mainline and regional jets. Based on these specifications, the Silvercrest family is considered most appropriate for all corporate jets in the super-midsize, large and long-range classes.

Brazil's Passaredo Linhas Aéreas introduces ATR 72-600

Brazilian carrier *Passaredo Linhas Aéreas* has introduced the new ATR 72-600 into its fleet after the airline and the US-based leasing company Air Lease Corporation (ALC) entered into an agreement for the introduction of four ATR 72-600s.

ATR and Passaredo have also revealed a contract for the purchase of ten ATR 72-600s plus ten options, valued at some $ 450 million. The airline will introduce the four ATRs leased from ALC and the ten firm aircraft booked with the aircraft manufacturer progressively in 2012, 2013 and 2014, thus bringing to 14 its total fleet of ATR 72-600s. In addition to this fleet of ATR 72-600s, Passaredo will also start operating this year two leased ATR 72-500s.

Pratt & Whitney and Irkut agreement on PurePower PW1400G

Pratt & Whitney and Russia's Irkut Corporation will offer the Pratt & Whitney PurePower PW1400G engine on Irkut's MC-21 family of aircraft, which secures the PurePower engine as the only western powerplant offered on the new narrow body programme. Pratt & Whitney and Irkut Corporation selected Short Brothers plc, a subsidiary of Bombardier Aerospace of Canada, as the exclusive nacelle provider for the PW1400G engine family.

Irkut is developing the MC-21 as a family of 150 to 210-passenger aircraft with first flight of the PurePower(R) PW1400G engined aircraft planned for 2015 and entry into service in 2017. The MC-21 series will feature jetliners with 25,000-32,000 pounds of thrust.

CFM56-7B sets new first-run world record

German airline TUIfly and CFM International celebrated a new first-run time-on-wing world record set by a CFM56-7B engine powering one of the airline's Boeing Next-Generation 737-800 aircraft. The engine logged more than 50,000 hours without a shop visit. The CFM56-7B engine was recently removed for LLP (life-limited part) replacement. Up until its removal, the engine was performing flawlessly and showed very good EGT (exhaust gas temperature) margin. EGT margin is the primary indictor of an engine's fuel efficiency. The airline has operated a CFM56-powered Boeing fleet exclusively for more than 24 years and currently operates a fleet of 40 CFM56-7B-powered aircraft.

Norwegian to procure 100 Airbus A320neo

Norwegian, one of the largest low cost carriers in Europe, has confirmed its order for 100 Airbus A320neos, following a commitment signed in January 2012. The order makes *Norwegian* one of the biggest A320neo customers. *Norwegian* (the brand name of Norwegian Air Shuttle AS) operates a network across Europe into North Africa and the Middle East and is rapidly expanding its low cost operations. The new aircraft will feature a single class cabin layout, seating approximately 180 passengers. The A320neo will support the carrier's growth and modernisation strategy.

ATR 42-600 certified by EASA

The ATR 42-600, which is a new member of its family of airliners has been granted certification from the European Aviation Safety Agency (EASA). This certification, prior to the aircraft's entry into service and for the plane's new equipment, marks the end of a series of ground and in-flight tests which were performed on the ATR 42-600 prototype.

Within framework of the test campaign, the ATR 42-600 benefited from its similarity to the ATR 72-600, which was certified in May 2011. As for the ATR 72-600, all of the tests on the ATR 42-600 were used to validate that the new systems and equipment installed on board operate correctly, especially the new "glass cockpit" avionics suite with 5 LCD screens, new communication, navigation and monitoring systems, flight management system (FMS), automatic pilot, alert management and multi-purpose computer (MPC, which integrates aircraft maintenance and protection functions in particular). Since the launch of the "-600" programme in October 2007, ATR has already received orders for a total of 250 ATR 42-600 and ATR 72-600 aircraft. Entry into service of the new ATR 42-600 is scheduled for summer 2012.

200th Falcon 7X enters completion

Assembly of the 200th Falcon 7X has been completed at Dassault's Bordeaux-Merignac facility in southern France. "We are especially proud of this milestone," said John Rosanvallon, President and CEO of Dassault Falcon. "The 7X is clearly the best seller in the current Falcon family and remains one of the most sought after jets in its category." Dassault Falcon has already delivered over 150 Falcon 7X's and another eighty are in various stage of production. The Falcon 7X fleet has accumulated over 130,000 flight hours since the first aircraft went into service in 2007, and is in operation in 32 different countries. Since the entry into service of the airplane five years ago, Dassault has developed dozens of new options that give customers a wide range of desirable features.

Laos national flag carrier adds to fleet of ATR 72s

At the Farnborough Airshow, ATR and the Vientiane-based carrier Lao Airlines announced the purchase of 2 ATR 72-600s valued at US$ 47 million, which will be added to Lao Airlines' current fleet of 4 ATR 72-500s. The airline is in the midst of expanding its fleet in order to increase frequency on existing routes and to open new destinations in the surrounding region.

Bell 429 for Fairfax County Police Department

Bell Helicopter has delivered a Bell 429 helicopter to the Fairfax County Police Department (FCPD). FCPD's second multi-role Bell 429 is configured for both law enforcement and emergency medical service operations. The FCPD's aviation unit received its first Bell 429 in December of 2011 and has since logged 600 flight hours and executed 900 missions. FCPD's 429 helicopters are configured for law enforcement operations and emergency medical service. In seven months, the FCPD's first 429 helicopter performed 40 medical evacuations and directly assisted in 34 arrests.

China Express Airlines order CRJ900 NextGen Aircraft

China Express Airlines has converted a previously announced conditional order for six Bombardier CRJ900 NextGen regional jets to a firm order and includes options on an additional five CRJ900 NextGen aircraft. Based on the list price of the CRJ900 NextGen airliner, the firm order contract is valued at approximately $264 million and could increase to approximately $491 million should the five options be converted to firm orders.

Textron wins Canada's tactical armoured patrol vehicle programme

Textron Systems Canada has been selected by the Canadian government for the *Canadian Forces Tactical Armoured Patrol Vehicle* (TAPV) programme. The contract provides that the Textron TAPV Team, led by Textron Systems Canada, together with Textron Marine & Land Systems and Rheinmetall

Canada, will manufacture 500 vehicles, with an option for up to 100 more.

The TAPV contract has a value of $603.4 million, with an additional five-year in-service support contract of $105.4 million, excluding GST/HST. The first vehicle is scheduled to be delivered to the Canadian Army in July 2014 and the last delivery is scheduled for March 2016.

Armoured combat vehicle contract for BAE Systems

BAE Systems will upgrade and build CV90 armoured combat vehicles for the Norwegian Army under a contract worth approximately $750 million, which was awarded by the Norwegian Government. The company will upgrade Norway's existing 103-vehicle CV9030 fleet, delivered from the mid-1990s, and build new vehicle chassis to deliver 144 CV90s in different configurations, including a variant equipped with a sensor suite for improved surveillance capability. The project will deliver 74 infantry fighting, 21 reconnaissance, 15 command, 16 engineering, 16 multi-role and two driver training vehicles. The multi-role vehicles can fulfill different functions, including mortar carrier and logistics roles.

US Navy displays Raytheon Griffin missile potential

The US Navy proved the ability of Raytheon Company's Griffin B missile to engage rapidly moving small boats during a recent live-fire demonstration."This demonstration shows the Griffin missile's effectiveness in engaging small, fast-moving boats used by swarming threats and pirates," said Harry Schulte, vice president of Raytheon Missile Systems' Air Warfare Systems product line. "Griffin is fully developed, in production, lightweight, precise, and can be easily integrated on a wide variety of vessels, making it an excellent weapon for near-term threats."

'Integrated Soldier System' solution by CAE and Elbit

Elbit Systems Land and C4I and CAE have signed an exclusive agreement to offer Elbit Systems' combat-proven Dominator-C and CAE's comprehensive in-service support programme to meet the Canadian Army's requirement for a next-generation *Integrated Soldier System* solution. Under the ISSP, the Canadian Army has established a requirement to significantly enhance tactical level individual and team capability, mobility and C4I performance to conduct land operations with such an integrated soldier system. Elbit and CAE have formed a strong Canadian team designed to offer "the best combination of technology, experience and in-country capability to meet Canadian-specific requirements while reducing technical, cost and schedule risks."

The fourth-generation Dominator-C is an integrated soldier system based on a proven suite of technologies. There are thousands of fielded and operationally proven systems worldwide. The Dominator-C Integrated Soldier System platform is light weight, low power, and highly integrated in a small form factor to deliver superior mobility and readiness. "It offers a real-time common operating picture on personal displays, allowing soldiers to send and receive live target and mission data as well as transmit images and positions up the chain of command."

Javelin missile proves new capability

Lockheed Martin and Raytheon Javelin Joint Venture demonstrated the capability to launch Javelin missiles from a vehicle in winter conditions at a test range in Norway. In a Norwegian Ministry of Defence-sponsored live fire demonstration in Rena, Norway, two Javelin missiles scored two direct hits when fired from a Piranha V vehicle configured with a Kongsberg Protector Remote Weapon Station (RWS) and the Javelin Vehicle Launcher (JVL) electronics. The two targets were located 800 and 1650 meters from the launch vehicle.

The RWS is a remote controlled weapon station for light and medium calibre weapons, and can be mounted on any type of platform. The JVL allows the standard Javelin missile round to interface with vehicle fire control systems. With the JVL, the US Army and international customers are able to fire Javelin missiles from vehicle platforms with the gunner safely under armour.

Cassidian electronics for German Army

Cassidian has provided for the German Armed Forces' new software-defined radio communications system (*KommSysBw*) delivering the system's first electronic components on time. The project, called "SVFuA" (*Streitkräftegemeinsame Verbundfähige Funkgeräte-Ausstattung* or Interconnectable Joint-Services Radio Equipment), is intended to optimise the Bundeswehr's jam-resistant mobile voice and data communications in the coming decade, particularly in missions abroad. Similar radio frequency components are already being delivered by Cassidian for NATO's data link programme MIDS (Multifunctional Information Distribution System). For this purpose, the company has set up specialised development and production facilities at its Unterschleissheim, Ulm and Friedrichshafen locations.

Sea trials of the F-105 frigate Cristóbal Colón

Navantia and the Spanish Navy have initiated final sea trials of the F-105 frigate *Cristóbal Colón*, in Ferrol (northern Spain), which continued for a week. During these sea trials, the shipyard tested the correct integration of the combat system in the platform, including trials of all sensors and weapons on board, as anti-air, anti-surface, anti-submarine, electronic war and communications exercises.

For the performance of several combat scenarios, Navantia will count on the collaboration of other surface units, including a F-100 class frigate, as well as land radio stations and communication satellites. Navantia has integrated the combat system SPY-1D (V) version on board, making the F-105 the most advanced of all the F-100 class. Also, it incorporates the highest level of indigenous sensors and weapons, which has been a big challenge for the shipyard.

FREMM frigate 'Aquitaine' launches first torpedo

Technicians from the DCNS, the French Navy and defence procurement agency DGA have completed a new test campaign aboard first-of-class FREMM multi-mission frigate *Aquitaine*, the most important of these being the first ever torpedo launch test from a FREMM frigate. After demonstrating FREMM frigate *Aquitaine's* compatibility with a 10-tonne Caïman helicopter (the French version of NH90) in March 2012, DCNS specialists spent several weeks putting the vessel's combat system, which includes the torpedo launch control system, through its paces.

After validating the torpedo tube configuration and performing dry-run tests, the DCNS team conducted the torpedo launch test

the on 22 June 2012. Using an exercise torpedo equipped with sensors and data loggers instead of a warhead, the launch was performed under otherwise operational conditions.

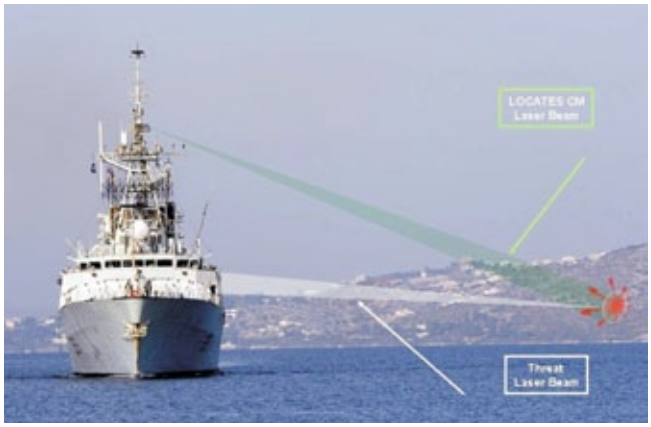
MBDA Exocet MM40 test fired

The Brazilian Navy has conducted a firing trial of an Exocet MM40 missile, equipped with a motor developed, produced and certified by Avibras in partnership with MBDA, which represents the country's autonomy in obtaining anti-ship missile motors and in the future, could also be used on other missiles, both national and foreign. The test was carried out in the open ocean from the Brazilian Navy corvette *Barroso*.

This firing and the cooperative development carried out between the two companies is part of the Exocet MM40 missile "renovation and operational maintenance programme" and for MBDA, is an element of its strategy aimed at creating long-term partnerships with Brazilian industry.

Cassidian protection for Canadian Naval Vessels

Cassidian, the defence and security division of EADS, is developing innovative solutions to protect ships of the Canadian Navy against asymmetric laser-based threats. Under



the designation LOCATES (Laser Optical Countermeasures and Surveilllance Against Threat Environment Scenarios), the Defence Research and Development Canada (DRDC), based in Valcartier/Québec awarded Cassidian a contract in 2011 to apply new technologies to detect and counter laser-based threats such as laser-beamrider missiles in harbours and littoral waters. The Critical Design Review has been achieved allowing the hardware development and integration of a demonstrator system, which will be field-tested in July 2012 until the second half of 2013.

Joseph Weiss is President and CEO of Israel Aerospace Industries

Following formal approval by Israel's Defence and Finance Ministers, Joseph Weiss who was selected by the company's board of directors, assumed office as President and CEO of Israel Aerospace Industries (IAI) on 1 July 2012, following Itzhak Nissan's retirement.

Dov Baharav, IAI's Chairman (left) congratulating Joseph Weiss IAI's new President & CEO

In his statement, Joseph Weiss, stated: "I intend investing as necessary to stabilise and fortify IAI as a global company, playing a leading role in areas of unique military systems, based on technology and innovation in space, in the air, at sea and on land, as well as combining advanced capabilities in the area of commercial aviation."

STOP PRESS

MI-6 warning on Iran's nuclear weapons programme

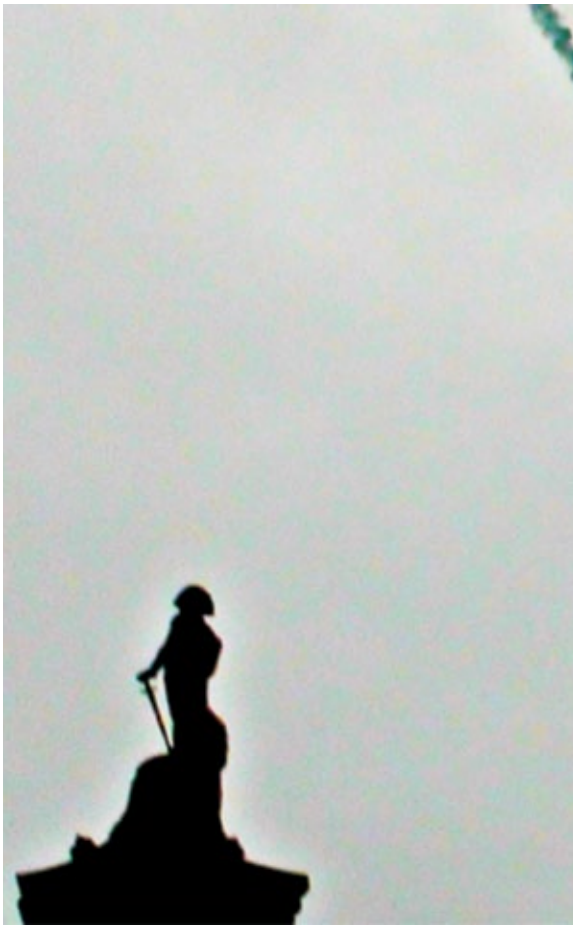
In a most unusual – and candid – statement, the head of Britian's Secret Service (MI-6), Sir John Sawers, has revealed that his "agents have foiled Iran's attempts to obtain nuclear weapons but the Middle Eastern state will succeed in arming itself within the next two years". Covert operations by British agents had prevented the Iranians from developing nuclear weapons as early as 2008, but Iran is likely to achieve their goal by 2014, making a military strike from the US and Israel "increasingly likely".

Continuing his warning, Sir John stated that a nuclear arms race in the Middle East could be more dangerous than the original East-West Cold War as there are not the same "safety mechanisms in place... which would be a disaster in world affairs".

Meanwhile, the Iranian Naval Chief Admiral Ali Fadavi, has issued a warning that they could prevent even "a single drop of oil" to pass through the Strait of Hormuz if its security is threatened "the Islamic Revolutionary Guard Corps (IRGC) naval forces have the ability to completely control the Straits".

Vayu Self AD

A Sign of the Times



This observer was in London, witnessed the grand events which included the magnificent 1000-boat flotilla on the Thames, the pomp and glory of marchers along the Mall, flypast over Buckingham Palace (more on that later). The climatic finale was when the night sky exploded with fantastic

Diamond Jubilee of Queen Elizabeth II

The atmosphere was charged with excitement and emotion as millions in Britain (as indeed in many parts of the World particularly the Commonwealth Nations) participated and cheered the four day celebrations, 2-5 June, 2012 to mark the Diamond Jubilee of Queen Elizabeth II's reign. The 'Diamond Jubilee' theme was displayed wherever possible, from gigantic Union Jacks painted on Heathrow Airport's tarmac, to flags painted on young girls' cheeks.

Queen Elizabeth II and family on board the Royal barge on the Thames

Hawks of the 'Red Arrows' aerobatic team fly over Trafalgar Square.

London's night sky explodes with fireworks.

fireworks after the Diamond Jubilee concert.

Now, a sign of the times : *Vayu* takes its readers back to the Coronation Review of the Royal Air Force in July 1953 when Queen Elizabeth II inspected the RAF at Odiham with 320 aircraft lined up on display with air and ground crews standing along side. Later, there was a flypast by 640 aircraft, comprising 193 piston-engined aircraft and 446 jets, at the relatively low level height of between 600-1200 feet. Awesome is an understatement!

In contrast, the flypast in June 2012 was modest by any standard : led by a Lancaster bomber, were four Spitfires and a Hurricane of the 'Battle of Britain' flight and then nine Hawks of the RAF Red Arrows formation aerobatic team. That's it ! Not even a handful of Typhoons or Tornados which would have been symbolic—if not substantial.

The 'Battle of Britain Memorial Flight' over Buckingham Palace : Lancaster bomber, four Spitfires and a Hurricane

British air power ....

....celebrates its centenary

A replica BE2 observation aircraft celebrates the centenary of its own design as well as the centenary of the Royal Aircraft Factory and the Royal Flying Corps at Farnborough in April 2012.

In April a double aviation centenary was celebrated at Farnborough. It was on 13 April 1912 that the Royal Flying Corps and Royal Aircraft Factory were officially created, paving the way for formal establishment of a combined British military air arm and pioneering aeroplane companies. The Royal Engineers Air Battalion, based at Farnborough, and a Naval Wing, based at Eastchurch, would form the basis of the new RFC, developing what had been a mix of enthusiastic and negative official views on aviation, but bringing,

A BE2 of the RFC flies over Farnborough in 1912.

an official centre for aviation research and development. This was the birth of air power and grew out of the previously fragmented activities carried out by the British Army and Royal Navy, supported by visionary individuals and small at last, government support for a cohesive organisation that recognized the potential of air power. And with increasing aviation progress in Germany, France and Italy, it was clear that more technical effort was needed if Britain was to be able to grow

Vayu's UK Editor, Richard Gardner, who is also Chairman of the Farnborough Air Sciences Trust, presented the current Commanding Officer of the RAF's No 2 Squadron, Wing Commander Nick Tucker-Lowe DSO, with a print of his painting of a BE2 flying over the RFC HQ in 1912

The special tail markings on a No 2 Squadron Tornado showing a BE2, with which the unit was first equipped 100 years ago in May 1912.

a home aviation capability that might supply the future needs of the Army and RN.

Little did anyone realise at the time that over the next six years British air power and manufacturing would see massive expansion with the production and operation of over 22,000 military aeroplanes. The First World War introduced the new concept of air warfare – a third dimension over the battlefield – which has remained dominant in military strategy to this day. This was truly the dawn of military aviation, and Farnborough was at its heart with the operational administration of early flying units and, in the Royal Aircraft Factory, a growing capacity to design, build and test not only engines and aeroplanes, but everything to do with equipping and operating them. While engine and aircraft production reverted to commercial manufacturers, the role of research and development testing continued after 1918 when it became the Royal Aircraft Establishment.

On 12 April, a replica BE2, the original of which first flew 100 years ago and which was designed by Geoffrey de Havilland and built at the Royal Aircraft Factory, returned to Farnborough skies and parked in front of the original RFC Headquarters, now the museum of Farnborough Air Sciences Trust, alongside the famous Black Sheds, where so many early RFC squadrons were formed and based. Participating at the celebrations were representatives from the first three squadrons, which went on to become Nos 1,2, and 3 Squadrons of the RAF. Later, an Army Air Corps Apache joined the BE2 and a DH Dragon Rapide in a fly-past over the former RFC HQ building, now known as Trenchard House, in memory of Hugh Trenchard, "The father of the RAF" who had his office there before taking the RFC squadrons to the Western Front in France.

Richard Gardner

UK Returns to STOVL

Richard Gardner reports from London

The first UK F-35B aircraft is now flying and will be delivered in July 2012 (Lockheed Martin photo)

On 10 May, the UK government made an announcement confirming its re-commitment to Short Take Off Vertical Landing (STOVL) future air combat capability. This followed a two year period of detailed re-evaluation of long term strike capability, from land and sea and in particular the proposed replacement aircraft for the RAF and Royal Navy Harriers. The result of this work has led to the decision to select the STOVL version of the Joint Strike Fighter, the Lockheed Martin F-35B model, rather than the previously selected naval C model. The studies relating to future aircraft needs aboard the two new 65,000 ton *Queen Elizabeth*-class carriers have shown that the cost and increased technical risk of fitting them with the as yet unproven US-supplied EMALS (electro-magnetic air launch system) together with increased training costs is unacceptably high and would also involve a greatly delayed entry into service (2023) which is now considered unacceptable. In contrast, the F-35B will enter land-based service in 2018 and carrier trials and work up can start soon afterwards, with full deployment from 2020.

The two new carriers, HMS *Queen Elizabeth* and HMS *Prince of Wales*, being built by a UK consortium led by BAE Systems, are currently at an advanced

Air Power

stage of construction, with major structural components delivered to the final assembly site in Scotland, and with many internal fittings already in place. Alterations to 250 ship compartments on each ship, and the modification of the US EMALS to make them suitable for use on the British ships, would have been far more expensive than originally envisaged (with the estimated costs rising from the original £1billion to £2billion.) The preparation period for a return to conventional catapult and arrested carrier operations would have added even higher costs. The adoption of the F-35B will allow for more flexible joint RAF/RN operations, as was the case with Harrier and Sea Harrier operations, but most importantly, apart from bringing forward an operational fifth-generation strike fighter capability into service sooner, using the existing ship deck design without further changes will mean that the RN will have the option of 100% availability of a large carrier, as two ships will allow for the period when one of them is in dock for re-fitting or maintenance, and there will be periods when both ships can be available. This was said by the Secretary of Defence, Philip Hammond MP, to represent far better value for money in what has become one of the UK's largest defence programmes.

The design of the QE-class aircraft carriers, with ski-jump ramps and very large deck space, three times the size of the existing *Invincible*-class British carriers, has been evolved to provide sufficient capacity of operate a range of aircraft including the F-35B, Merlin, Chinook and Apache helicopters. The standard complement of F-35Bs will be 12 aircraft, but up to 40 can be handled if required. Both Royal Air Force and Royal Navy squadrons will operate the new type and pilots from both services will be trained to fly from the ships. The F-35B will have a highly automated recovery system at its disposal, and the carriers will have very sophisticated onboard systems. The landing system has been developed in the UK using a specially modified two-seat Harrier fitted with fly-by-wire controls and a QinetiQ-developed automated landing system that uses differential GPS technology to achieve fully "hands-off" precision landings, in day or night conditions in any weather. This will make intensive carrier operations safer, considerably reducing pilot workload and will enable a higher number of mission sorties to be flown off the deck in a given period compared to conventional naval aircraft carrier operations. Once the returning aircraft has been flown by the pilot into the carrier approach "box", the automated landing system will "capture" the landing parameters and guide the aircraft to transition from forward flight to the hover and then land on a precise deck spot. This will allow near simultaneous landings to be achieved fast and safely, based on previous Sea Harrier experience, but taking automation to a new level.

The Harrier automatic landing trials, undertaken over a number of years, have been followed by the development of virtual training tools to help the Royal Navy in the planning of future carrier deck handling management based on F-35B aircraft. If the F-35C had been

An F-35B seen making a vertical landing on the USS Wasp (Lockheed Martin photo)

continued, this work would have had to be abandoned and a whole new conventional training programme developed in its place. When the new British carriers were first announced, it was stated that they would be built with very advanced automated systems for the storage and delivery of weapons and other payloads within the ship. This uses robotic technologies adopted from the automotive and logistics sectors and will result in a major reduction in manual tasking onboard the ships, reducing the total number of crews needed and speeding up the operational turn round of aircraft, re-loading with weapons and refuelling in times of conflict.

Since the UK government stated its intention to switch its F-35B orders to the C model two years ago the development and flight trials programme in the USA has made significant progress. The fact that the F-35B has now demonstrated a high level of reliability in carrier deck trials has persuaded the British government that it offers a better, more cost effective option for future UK needs,

BAE Systems at Samlesbury has recently completed a major new production facility to manufacture and assemble rear fuselages for all F-35 variants. (BAE Systems photo)

and so the B model is now back as the chosen platform for UK squadrons. The C version would have been cheaper, but the ship modifications and support costs to operate it would have been much more. This decision will have many benefits, including renewal of the close working relationship between UK and US Marine Corps squadrons, and will also allow cross operating with the F-35B aircraft that Italy intends to buy. In terms of UK industrial commitment to the F-35B, the

programme is a joint venture between the UK and US, and BAE Systems has a large share in the design and build of many systems and components, including the rear fuselage, automated systems and pilot's integrated helmet display. Rolls-Royce is also a partner with Pratt&Whitney on the STOVL version of the powerplant, providing the swivelling rear engine nozzle and geared forward lift-fan, as well as roll stabilisers.

There is continuing work being undertaken by MBDA on plans to fit the Meteor Beyond Visual Range ramjet powered long range AAR missile internally in the F-35Bs that the UK will operate. The MBDA ASRAAM can be carried either internally or on wing pylons, and flight tests have now been undertaken with pylons fitted to a B model of the US Marine Corps. Air-to-Air refuelling tests have also been successfully carried out by an F-35B carrying pylons. The UK has said that its F-35Bs will use buddy air-to-air refuelling on a routine basis to extend range and endurance when operating from aircraft carriers. This revives an operational practice that was developed by the UK in the 1940s and subsequently used by the Royal Navy since the 1950s.

An F-35A conducting AAR trials with a USAF KC-10 tanker using the refuelling boom method.

HMS *Queen Elizabeth* is due to start sea trials in 2017 and flying trials with UK F-35Bs will start the following year. In the USA, the first UK F-35B has recently started test flying, and this aircraft, one of three ordered for test and evaluation, will be delivered in July 2012.

An F-35A with a full set of underwing pylons.

F-16 formation at Frisian Flag (photo: RNLAF)

Exercise Frisian Flag 2012

"Stingray 51 cleared to land runway 24". A Swedish JAS-39 Gripen normally based at Luleå comes in to land at Leeuwarden Air Base during the Frisian Flag 2012 exercise held during the last two weeks of April of 2012. Leeuwarden - normally home to two MLU F-16s and a trio of SAR AB 412s of the *Koninklijke Luchtmacht* (Royal Netherlands Air Force) – is overcrowded with almost 50 jets from nine different countries flying two waves a day. Add to these already significant numbers the some 20 support aircraft operating from their home bases, Dutch ground-based air defence (GBAD) and naval vessels and you have all the ingredients for one of (if not the) largest annual NATO exercise in Europe.

History

The history of Frisian Flag goes back as far as 1992. In that year the first multinational exercise was held called DIATIT. The name DIATIT (Diana Tactical Integrated Training) was based on the organising 323 TACTES Squadron nicknamed *Diana* which is goddess of the hunt and is featured in the badge of the squadron. In 1993 the exercise was renamed as DIAWACS to emphasise the first time participation and important role of the E-3 AWACS in the exercise. Next to its role as airborne radar station, the E-3 made it possible to add High Value Air Assets (HVAA) defence training to the scenario. DIAWACS reverted back to its original name DIATIT in 1997 and 1998 owing to the lack of E-3 AWACS participation. Growing international

SwAF JAS-39 Gripen

participation and interest in 1999 made the organisation decide to choose a more international name which it carries today: *Frisian Flag*.

Leeuwarden-based 323 Squadron gained its current status of Tactical Training Evaluation and Standardisation Squadron (TACTESS) in 1992. Since then, the squadron has been involved in organising annual exercises (Frisian Flag), as well as the regular national and international Fighter Weapons Instructor Training (FWIT) courses and ATTIC course (Advanced Tactical and Technology Intelligence Course) at Leeuwarden. This year's *Frisian Flag* exercise was the first edition in three years. The 2010 edition was called off at the end of the first week after volcanic ash from the Icelandic volcano put a ban on both civil and military flights in big parts of European airspace. Last year's edition never took place as both the organising as well as most of the participating countries were involved in Operation *Unified Protector* (OUP) over Libya.

German Air Force Eurofighter

Objectives

Initial preparations for *Frisian Flag* 2012 started about a year ago. The exercise was organised by a relatively small team – just 12 people – under the command of Lt Col van Deventer. Captain Kiens who co-ordinated the exercise together with Captain van Meerlant said: "With all participating nations, we train in the Offensive and Defensive Counter Air – or OCA and DCA – roles in realistic large-scale multinational scenario, with emphasis placed on the effective integration of all available assets – in the air, on the ground and at sea."

According to Captain Kiens: "Exercises like these are very important to us. As you know, our Air Force has been heavily involved in the Operation *Enduring Freedom* in Afghanistan as well as the Operation *Unified Protector* (OUP) over Libya. These operations once again clearly proved the extra value of exercises in which pilots and aircraft from different nations operate together in large packages."

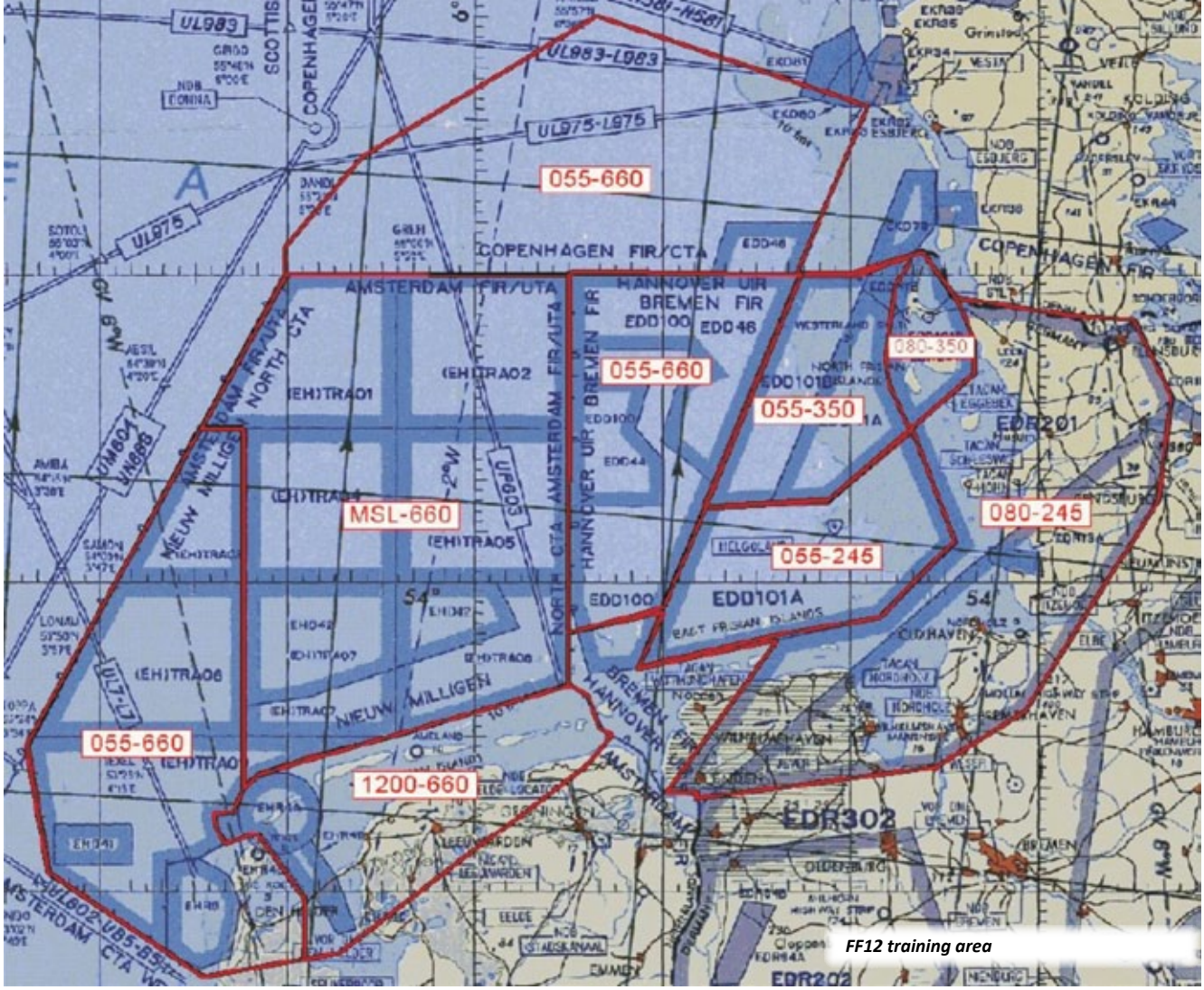
Dutch F-16 formation

Naturally, lessons learned from exercises can be applied to wartime situations, but it also works the other way around, as Kiens explained: "Many of the pilots taking part in this exercise were involved in the operations already mentioned. Their recent experiences have already been incorporated into this exercise." Consequently, the scenarios flown during *Frisian Flag* were adjusted so as to be more up to date than they are for the current American Flag exercises, that are planned well ahead.

Assets

Participants based at Leeuwarden during *Frisian Flag* comprised six German Eurofighters from Nörvenich and six British Typhoons from Coningsby which were both first timers to the exercise. A strong delegation from Scandinavia was

Finnish F-18



FF12 training area

present in the shape of eight Swedish Gripens from Luleå, six Finnish F-18s from Tampere and ten Norwegian F-16s from Bodo. A Norwegian Da20 from Rygge was added in the second week in the electronic warfare role. Among the numerous F-16s participating were fourteen Dutch F-16AM and F-16BMs from both Leeuwarden and Volkel, six Belgium F-16AM and F-16BMs from Florennes and six, second time participant, Polish F-16Cs normally based at Lask. A civil LJ-36A from Skyline Aviation flew missions from Leeuwarden in the electronic warfare role only the first week of the exercise.

A number of aircraft participated from their home bases. The United States Air Forces Europe daily sent eight F-15 Eagles from Lakenheath,UK in the air defence role. Tanker support was provided by KC-135s from Mildenhall, UK, Tristars from RAF Brize Norton, UK and a KDC-10 from Eindhoven-based 334 Squadron. A NATO E-3A flew the morning and the afternoon missions as the British E-3Ds were grounded. First timer for the Exercise was supposedly the Sentinel R1 from the RAF based at Waddington. Unfortunately the aircraft was grounded as well. It only flew one mission on 20 April and thereafter was subsequently simulated by the (Dutch) National Datalink Management Cell to get the training value requested for the exercise.

The Dutch GBAD units deployed were used to simulate Russian air defence systems. They were positioned with the Patriot BCP (Battery Command Post), radar and launchers at the army training grounds in the Marnewaard polder, about 50kms northeast from Leeuwarden. Supporting units where placed at Leeuwarden among these the Patriot ICC (Information and Coordination Centre). A Dutch Naval frigate, the *Evertsen* (F-805), joined the Link-16 network during the exercise but during the first week only for their own training purposes with Link-16. an example of how more parties benefit, although not participating, from a large exercise like *Frisian Flag*.

Training areas and missions

The main training areas used for *Frisian Flag* 2012 included the nine Temporary Reserved Airspaces (TRAs) over the North Sea that the KLu has at its disposal. Further airspace utilised included German (D-100, D101A and ED-R201) and Danish (EK-D301 and 304) TRAs, the Vliehors shooting range, Marnewaard CAS area and Terminal Control Area (TMA-A) around Leeuwarden. Two air-to-air refueling areas (named Shell and Esso) were situated on the edges of the training area , one in the west and other in the northeast.

Airspace was reserved from ground till flight level 660 which equals 20 kilometers. The "hunting grounds" which were at disposal of the pilots covered an area of about 270 by 330 kilometers. Arrangements had to be made with the civil users of the airspace to avoid simultaneous usage. In general everything went well except for one morning when two aircraft flew outside the exercise area boundaries. After consultation with civilian air traffic control this mission was cancelled and all aircraft were ordered to return to Leeuwarden.

The tasking for the pilots was very diverse. One of the missions could be an air defence mission in which part of the air space had to be defended against intruding enemy airplanes or the protection of other aircraft. Furthermore simulated attacks on ground and sea targets had to completed with "fierce resistance" from both enemy airplanes and missile defence systems. For example Wittmund Air Base in Northern Germany was used more than once as a target. Being protected by a SA-8 *Gecko* surface-to-air missle system and T-72 Soviet-designed battle tank at the former Husem Air Base and SA-6 *Gainful* mobile surface-to-air missile defense system at Nordholz Air Base, made the exercise even more challenging.

During an afternoon mission on 19 April things became even more realistic than anticipated. Two Russian Air Force Tu-95 Bears were patrolling the North Sea area. After the Danish Quick Reaction Alert (QRA) finished shadowing of the Tu-95s in Danish air space, four *Frisian Flag* players were retasked during the exercise to follow them. *Archer* 03/04 (Leeuwarden F-16s) and *Ivan* 21/22 (Florennes F-16s) were directed to the Russians Bears by Bandbox (CRC) making this *Frisian Flag* mission one to never forget!

NDMC and Link-16

A vital ingredient for this year's exercise was presence of the (Dutch) National Datalink Management Cell (NDMC). Normally based at the Air traffic Control Centre at AOCS Nieuw Milligen, a mobile component with an eleven persons staff was send to Leeuwarden, the NDMC was responsible for the Link-16 structure and simulation of Link-16 assets. Link-16 is a military tactical data exchange network. With Link-16, military aircraft as well as ships and ground forces may exchange their tactical picture in near-real time. Link-16 also supports the exchange of text messages and imagery data.

Asking the commander of the NDMC, Major Remmelzwaal, about the role of Link-16 during *Frisian Flag* he answered: "During Operation *Unified Protector* (OUP) over Libya Link-16 was largely used. Next to the exchange of the usual air picture also information regarding targets, assignments and changes, airspace structure and own forces were shared. The digital information spread through Link-16 reaches those involved faster than the spoken word and doesn't burden with interpretation and/or language differences (what you see is what you get). It allows the pilot to absorb more information and gives him less work pressure in the cockpit."

Of all the participants of *Frisian Flag* only the Swedish Gripens and Finnish F-18s were not Link-16 capable. Their aircraft are going through a modification programme which will allow them to use Link-16 in the future but this is not a problem for the exercise as explained by Major Remmelzwaal. "The fighter allocators onboard the E-3 AWACS and at the Control and Reporting Centres (CRC) will pass all available information through voice communication. It is also the Mission Commander's responsibility to provide all necessary information to all players during the flight."

Air Control

Often forgotten but not unimportant in an exercise of this magnitude is Air Traffic Control (ATC). Air Control is the situation whenever pilots are in radio contact with a Frisian Flag Air Controlling Unit(ACU). Radar-equipped ACUs (ATC and Fighter Controller e.g. CRC or E-3 AWACS) provided certain levels of flight assistance whilst from non-radar equipped ACUs (Forward Air Controller

RAF Eurofighter Typhoons.

and Range Control) pilots did not receive flight assistance.

One of the ATC units to provide air traffic control was Radar Approach Control North, callsign *Rapcon North*. It provided ATC guidance during departures and recoveries from/to Leeuwarden and monitored Nieuw Milligen TMA-A. Asking one of the Rapcon North controllers Captain Van Es about *Frisian Flag* he was very clear: "Exercises like these are the tip of the spear. Normally we handle traffic loads of about ten aircraft in a mission but during *Frisian Flag* around forty five. To make sure both controllers as well as controller assistants were prepared for such an increase in traffic volume we spend a few days in the 3D simulator here at AOCS Nieuw Milligen. It is currently the best 3D ATC simulator with 360° round view. The tower controllers from Leeuwarden did 3D simulations for the departure and arrival sequence while the Rapcon/Arrival simulator was incorporated in these scenarios. Our Rapcon team not only trained arrivals and departures but also emergencies and other not so common scenarios. We were ready!".

Successful

According to Kiens: "We succeeded in offering a low-budget, high quality exercise to the participating air forces. We can only send a limited number of pilots to exercises like *Red Flag*, owing to the high costs involved in deploying aircraft and personnel across the Atlantic, and the fact that we have to pay to participate. Here, we can have more pilots fly their missions in this kind of exercise, hardly

without additional costs." Participants don't have to pay to participate in *Frisian Flag*, the costs were therefore mainly limited to fuel and hotels.

Participating aircrews were equally positive about the exercise. Lieutenant Colonel Mansikka, an experienced aviator, commanded the Finnish F-18 Hornet detachment of HävLLv 21 at Leeuwarden. He said:" This exercise offers probably the best training we get here in Europe. The inclusion of different aircraft types, the realistic and current scenarios and the general professionalism were "pretty excellent", according to Mansikka. A critical note from his side was that the Finnish F-18s only got the chance to do air to air refueling twice whilst other players got more opportunities. Other than that all goals for his squadron were met including giving young aviators the chance to be flight leaders or mission commanders during large combined air operations like.

The Future

Frisian Flag 2012 was a big success. Some missions were flown under challenging conditions like thunderstorms. All goals both exercise as well as a squadron's own were met and the exercise was pretty much flawless. The future for an low cost exercise with so many different participants and assets looks bright. More countries have shown interest in the exercise notably. Spain and Italy. Preparations for next year's exercise are already in full swing!

Text by Remco Stalenhoef/ Stephan van Geem/ Patrick Smitshoek. Photos: R. Stalenhoef

Book Review:

'The Tail Hooker'

The reviewer, Admiral Arun Prakash (Retd), originally a 'tail hooker' himself, subsequently switched to the 'vectored thrust' fraternity.

Everyone knows that "hooker" is a pejorative expression, but not many are aware that the term "tail hooker" is derived from a metallic device attached to the belly of a ship-borne aircraft. Its purpose is to catch one of the four strong steel cables stretched across the flight deck of an aircraft carrier in order to bring the aircraft to an abrupt stop ! 'Tail hooker' is, thus, the cherished nickname proudly borne by those naval aviators who qualify to operate from an aircraft carrier using this device; in this case, it refers to the author of the work being reviewed.

It is, however, difficult to leave this theme without mention of the famous Tailhook Association. A professional-cum-social fraternity of US naval aviators, its 1991 annual symposium, held in Las Vegas, featured a two-day debrief on Operation *Desert Storm*. Allegations of misconduct by participants led to a Department of Defense inquiry, whose report found that numerous instances of assault and harassment of women participants had occurred during the event.

Tailhook 91 ultimately led to fourteen admirals and 300 naval aviators being disciplined or forced to resign. The term tailhook has, ever since, retained a certain notoriety.

Having got the etymological trivia out of the way let me turn to a more pleasant topic. I picked up 'The Tail Hooker'; only to find that I could not put it down. A little reflection told me that this was not merely because Commander Sareshth Kumar had been a younger colleague and fellow naval aviator of long standing. Or because many of the stories he relates are set in familiar locations, and describe recognisable characters. The reason lay elsewhere.

The charm of this slim volume, I realised, was concealed in its disarmingly frank style, and the way in which the author has strung together a series of vignettes of his naval experiences in bite-sized chapters. Above all, he has managed to convey his thoughts in simple but well-composed prose, laced with occasional Hindi and Punjabi quotes. In essence, it is a book that every reader will wish that he had written, but never had the time or talent to do so!

The central character of this thinly disguised auto-biography is a person with a self-deprecatory, if sardonic, sense of humour,who introduces himself as an "ordinary boy" raised in Delhi's East Vinay Nagar, from where he could see Pushpaks and Dakotas operating out of Safdarjung airport. His ambition in life is to be in the cockpit of a "Mystere, Hunter or Gnat streaking across the sky". But there are two flies in the ointment. One of them is his father whom he placates by agreeing to earn a degree which he does from an "oddly named" institution of higher learning called Atma Ram Sanatan Dharam College. The other is his girl-friend who is cruelly opposed to him streaking across the sky in anything.

The aspiring pilot, to his joy, is selected as an Aviation Cadet for a Short Service Commission in the Indian Navy. What follows is a kaleidoscopic account of his travails and triumphs as he learns to fly with the air force, earns his pilot's wings and is then thrown headlong into the exotic world of naval aviation where one has to learn to be both fish and fowl.

Eccentric flying instructors, whacky course-mates, sea-yarns and heady tales of aviation adventure, interspersed with reports of our hero's turbulent love-life are what make this book an absorbing read. The dénouement comes virtually on the last page as the tail hook of his Sea Hawk plucks a wire from the deck of INS Vikrant to bring his "speed from 183 kmph to zero in less than two seconds". He has achieved his life's ambition and is, at last, a "tail hooker".

Matrimony follows shortly as his lady-love relents !

Having tasted blood with his first literary venture, I suspect that Sareshth Kumar, a flying instructor and a test pilot who has flown many aircraft types, probably has a couple of more books in his head. This book happens to be just a minor contribution by Sareshth to the Fleet Air Arm. His daughter was married to a Sea Harrier pilot, who lost his life in a tragic accident at sea in 2009. Sareshth's son, also a naval fighter pilot, awaits the arrival of INS *Vikramaditya* to emulate his father and become a tail-hooker on the MiG-29K.

No matter what your connection with aviation, or even if you are an earthbound creatures, this is a great week-end entertainer. As a bonus, there is an illustrated appendix which could be titled 'Deck Landing for Dummies'

Author : Sareshth Kumar,
(Pashmira Publications, Chinchwad, Pune, 2012; 230 pp; Rs. 225.00)
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25 Years Back

From Vayu Aerospace Review Issue III/1987

The IAF over Jaffna

Five Antonov An-32 transport aircraft of the Indian Air Force escorted by four Mirage 2000 fighters, airdropped some 24 tonnes of relief supplies over selected zones in the Jaffna peninsula of Sri Lanka on 4 June, 1987.

'Operation Poomalai' (Garland) was the consequence of the previous evenings' refusal by the Sri Lanka Navy to allow Indian fishing vessels, under the Red Cross Flag and carrying similar food and medical supplies, to enter Sri Lankan waters.

'Operation Meghdoot'

Although the Indian Air Force maintains continuous air maintenance support of Indian Army troops in the Siachin area of northern Ladakh, reports have it that the second half of June 1987 was particularly crucial in support of operations in the area. IAF An-32s and Army Cheetahs have airdropped supplies and ferried troops to forward posts at very high altitudes in this area where Indian and Pakistani forces have clashed for some three years.

It is felt that the prolonged military occupation of the glacier could touch off a wider conflict. Either a solution has to be worked out in declaring the high ridge of the Saltoro Ranges as the LOC or the Indian forces would have to occupy more favourable positions from the point of view of defence and maintenance.

Chinese missiles 'aimed' at India

According to a noted American expert on Tibet, Chinese build-up of nuclear weapons there includes 70 medium range and 20 intermediate range missiles based just 260km north of Lhasa, at Nagchuka. In a major account of China's military build-up on its border regions with India, he said that Tibet's militarisation includes 17 secret radar stations, 14 major airfields and vast underground bases in the eastern and western sectors of the Himalayan front.

Civil Aviation matters reviewed

The Minister for Civil Aviation has said that the State-owned Pawan Hans Ltd has now acquired 23 helicopters, all of which are fully deployed with ONGC, some state governments and the Union territories of Andaman & Nicobar Islands and Lackshdweeep as well as for training purposes.

Meanwhile, Indian Airlines has increased its capacity on 18 old routes and has introduced new links on nine new routes while Air India has included three additional services in July on the India-Europe sector and it is also proposed to extend the night fare scheme to the routes Bombay-Madras and Bombay-Calcutta.

As regards Vayudoot, the year 1986-87 is being projected largely as a period of consolidation so that perceptible improvement is brought about in maintenance practices, operational procedures and on-time performance.

US offers E-2Cs to PAF

The US Administration has offered the supply of two Grumman E-2C Hawkeye airborne early warning aircraft for the Pakistan Air Force to assist against air violations by Soviet-built aircraft flying from Afghanistan. Senior Pakistani officials visiting Washington recently have stated their strong preference for the Boeing E-3A but Administration officials feel that this would not be practical from a financial standpoint.

Soviet border intrusions have increased "to more than two per day" and that "up to 28 April of this year alone, there have been more than 400 intrusions of Pakistan air space, 84 of them deep penetrations and more than 100 involving serious bombing and rocket attacks".

PAF and the Chinese connection

A high level Pakistani defence delegation, led by Pakistan's new Vice Chief of Army Staff, is to visit China in mid-July in order to finalise a number of new defence supply deals, including the purchase of some 20 F-7M fighters. Reports from Western sources state that the Chinese F-7Ms for Pakistan will probably be re-engined (with the GE F-404) and incorporate advanced avionics plus HUD and a weapon aiming computer. The PAF would eventually replace the current force of F-6s with the F-7M but is also stressing the need to expand its F-16 force, currently at 40 aircraft less attrition, to some 100 numbers.

Nigerian interest in HTT-34

The Nigerian government is currently negotiating the procurement of 24 HAL HTT-34 Allison 250-powered ab initio trainers for the Nigerian Air Force in a barter deal for oil. A Nigerian team has recently visited HAL's Kanpur Division to evaluate the HTT-34.

Iraq orders PC-9

The Iraqi Air Force is the fifth customer for the Pilatus PC-9 basic trainer, the initial Iraqi order being reportedly for some 15 aircraft. Iraq has previously purchased 52 of the lower-powered PC-7 Turbotrainers, the bulk of which are operated by the Iraqi Air Force College at Tikret. The Iraqis has also received the bulk of 80 Egyptian-assembled EMB-312 Tucano basic trainers and have an option on 20 more.

STOP PRESS : IAF airlifts Indian troops to Jaffna

Within hours of signing of the Indo-Sri Lanka agreement on 29 July 1987, designed "to establish peace and normalcy in Sri Lanka", some 24 Antonov An-12s and An-32s of the Indian Air Force flew into Palay airfield near Jaffna town in northern Sri Lanka with the bulk of two Indian Army battalions constituting a 'Peace Keeping Force'. By 31 July, bulk of an Indian Infantry Brigade had been landed in Northern Sri Lanka, while heavy equipment and stores were transported by sea.

As part of the military assistance being provided by India is the airlift of Sri Lankan troops by IAF transports from the north to other parts of the Island republic. As a fall out of the agreement, Sri Lankan forces are, ironically, needed to meet the threat of turmoil in the southern areas while the induction of Indian troops in Jaffna to enforce the cessation of hostilities will give a new dimension to the sensitive political situation in the peninsula.

Isn't She Beautiful ?

In this beautiful image of planet Earth, seen from 36,000 kms above in space, the Indian sub-continent is literally 'Centre of the World'. The image was taken by Electro-L, Russia's latest weather satellite which captures this kind of stunning image every half hour. Electro-L is in a geo-stationery orbit, which means its speed matches that of the Earth's rotation, making it remain 'motionless' above a fixed point of the plant. It was launched in January 2011 and has been beaming down these stunning images ever since.

But, *'Nazar Na Lag Jaye'* *

Therefore it is distressing to say the least that India is amongst the countries most likely to face catastrophic damage caused by asteroids. Research from the University of Southhampton have identified for the first time those which will suffer catastrophic loss of life or be so crippled it will be almost impossible for them to recover.

NASA's Wide Field Infrared Survey Explorer has sampled 107 "potentially hazardous" asteroids near Earth - 330ft wide or larger - to make estimates about how many are out there - and the figure is a terrifying 47,000.

* *Ward off the evil eye*

Bombardier

ShinMaywa